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Index to Advertisers—Page xl.

Principal Contents:

	PAGE
Non-statutory Undertakings	635
The Empire Exhibition	637
Directive Radio-Telephony	640
Air-dielectric Cables. By E. W. Smith	641
The Cooking Peak. By V. G. Clark	643
The E.A.W. Conference	645
A Welsh Cable Factory	647
Modern Refrigerator Manufacture	648
Meetings and Discussions	649
Correspondence: Organisation of Non-statutory Suppliers; Low Voltage Loses Client; Working to Music; The Design of Electric Cookers; High-voltage Technology; Salaries Schedules; The Case of the Shift Engineer	651
Timing London's Buses	655
Business and Industrial Notes	656
Electricity Supply	660
Communications and Traction	662
Contract Information	663
Our Personal Column	665
Financial Section	665
Published Specifications	669
New Work for Contractors	670

Non-statutory Undertakings

How will they be affected?

A COMMON way of comparing the state of electrification in different countries, or of progress from year to year in any one country, is to take the number of kWh consumed per head of population. For Great Britain the figure given in the last annual report of the Electricity Commissioners was 366 kWh. This was calculated from known sales by some 620 undertakings distributing under Parliamentary powers.

The figure leaves out of account, however, the large consumption of electricity that falls outside the scope of official statistics, and which is estimated to add quite one-third to the total. This additional amount is used by large industrialists and traction concerns operating their own generating plants, by the public supplied from such plants, and by the public supplied from independent systems.

The first group, which is diminishing, does not concern us here. The position of the second group, being mainly composed of tenants and employés on estates adjacent to the works, is not so much to our present purpose as are those systems that have been constructed specifically for meeting the electrical requirements of a locality but which are not constituted under a Special Order.

It is difficult to assess the number and importance of such unauthorised distributors. Many of them are not registered as companies. The smallest of those that are is surely the Symondsbury Electric Lighting Co., Ltd., with ten consumers and a maximum demand of 1 kW, but there are undoubtedly many other suppliers of comparable output, among them residents in villages who allow their neighbours the benefit of electricity derived from their small engine sets or waterfalls.

As things are, there is nothing to prevent anyone from starting to supply electricity to other people, provided there is no legally authorised undertaking for the area in question. If such an undertaking acquires powers subsequently, that does not debar the original non-statutory concern from continuing and extending its supplies. Even the pre-existence of an authorised undertaking forms no obstacle to the giving of supplies from private plants, so long as this activity is not the main business of the "pirate."

There are certain advantages in working on a non-statutory basis. No cost is incurred in acquiring an Order; only a limited area (containing the cream of the load) need be served, and then without obligation to supply all and sundry within a certain distance from the mains; the voltage need not be maintained within prescribed limits; and the undertaking is not subject to compulsory purchase after a term of years. Moreover, load can be secured on the most suitable terms without having to quote the same tariffs to similar consumers.

On the other hand, non-statutory undertakings possess no powers to break up streets without permission from local authorities. When they adopt overhead construction, they are subject to the regulations of the Electricity Commissioners and the Postmaster-General. In erecting and extending generating stations they are again subject to the Commissioners.

Non-statutory suppliers have, on the whole, done good pioneering work and still fulfil a useful purpose in many instances. But will their perpetuation be in the best interests of consumers? The McGowan Committee evidently thought not, as it suggested that no unauthorised supply should be given to new consumers in the area of an authorised undertaking without its consent, subject to appeal to the Electricity Commissioners. The Committee also expressed the view that authorised undertakings should be entitled to take over the lines and works of any non-statutory suppliers within their areas on the basis of capital expenditure less depreciation.

Sometimes the purchasing undertaking might find the non-statutory system of doubtful value as a permanent capital asset. Nevertheless, the importance of the spade-work done in building up a nucleus load and in creating an electrically receptive local outlook deserves adequate recognition.

In our "Correspondence" section to-day Mr. Theodore Stevens urges the need for non-statutory suppliers to get together. If for no other reason than that of devising standards of reasonable treatment in view of possible legislation, the formation of a body representing their interests would appear to be desirable.

The Empire Exhibition

A NUMBER of organisations and companies are upholding the banner of the electrical industry at the Empire Exhibition, Glasgow, which was opened by His Majesty the King on Tuesday last. Moreover, electricity is of the essence of the show; its influence is apparent on every hand, above all in the very lavish display of lighting, which is probably the Exhibition's greatest feature. On another page we give an outline of the arrangements and touch upon a number of the electrical exhibits to which reference will be made at a later date. The industry, as a whole, owes a debt to those who have contributed to the display for a very telling electrical advertisement.

Probability

SELDOM can the statistical approach towards the interpretation of fundamental physical processes have been more ably introduced to a gathering of men with a comparatively rudimentary acquaintanceship with the subject than it was in this year's Kelvin Lecture at the Institution of Electrical Engineers. The support of theoretical deductions by experimental methods was of a kind to make an instant appeal to engineers, while a knowledge that an element of chance enters into the application of the laws of Nature should act as a healthy corrective to any complacency in their outlook. On the other hand, the probability of achieving constant effects from given causes is great enough to enable them to work with a confidence that is, for all practical purposes, based on a certainty. There was, at any rate, an overwhelming certainty implied in the welcome accorded the lecturer that I.E.E. members regarded Dr. Max Born as a most brilliant acquisition to the band of physicists at work in this country.

Food and Fitness

THE recent establishment of "keep-fit" classes and the numerous sports facilities now available have aroused remarkable public interest in national fitness, but has not the more fundamental and more difficult side of the question, that of nutrition and dietetics, been rather "left in the air?" An undernourished body can never be fit, yet how many housewives have taken the trouble, or, for that matter, have had the opportunity, to learn the first thing about the subject. Cost, of course, plays a big part in the problem, but even the most inexpensive foods can be made appetising if a little trouble is taken. To assist the housewife in giving her family the best food value possible for her money is the object of the latest campaign inaugurated by the Electrical Association for Women. It is in such domestic matters as these that the value of this Association, both to the nation and the electrical industry, is most apparent. For what point is there in obtaining good food and then spoiling it in the cooking? The E.A.W. can be depended on to see that the advantages of electric cooking are not overlooked.

London J.E.A. Finance

THE London and Home Counties Joint Electricity Authority and the Electricity Commissioners are at loggerheads. The J.E.A. is unable at present to balance its revenue and expenditure, owing, it says, to the burden placed upon it by the too-rapid redemption of its loans. It hopes, however, to reach a state of equilibrium in 1942. The Commissioners consider that this desirable state should be reached two years earlier, but the J.E.A. says that this can only be accomplished by raising charges, which it considers is unjustifiable and will retard development. Whatever the real facts may be, the Authority's consumers will certainly agree that they should not be asked to pay more. Already in some of the Authority's area consumers are restive at having to pay more for their electricity than their immediate neighbours—in Surbiton, for instance, a densely populated borough which adjoins Kingston and Wimbledon areas, which both enjoy lower rates. In the long run, no doubt, the saving of interest by rapid repayment will have a beneficial effect, and perhaps it is not bad finance to look to that future saving to meet deficits incurred now. In any event, it is doubtful whether increased charges will do any good, and probably the long view is the better one.

Aiding a Distressed Area

WHETHER the merits of underground cables will enable them in the future to make serious inroads into the spheres usually assigned to overhead construction on account of lower initial expenditure, as suggested by some authorities, is a moot point. There is no doubt, however, that there is likely to be an increasing demand for inexpensively produced paper-insulated cables up to 11 kV. The response of Aberdare Cables, Ltd., to the appeal by the Government a year ago for the establishment of industries in areas most urgently in need of new enterprises (particularly where they were not benefiting by one of the "trading estates") would appear to be of the appropriate kind. The factory, which has now started production, has been completed in a remarkably short time considering the amount of thought entailed in securing the latest developments in plant called for by the intricate processes involved in cable manufacture. Moreover, in such areas land is available, and in Aberdare, no longer a prosperous mining town, there is a pick of men able and willing to be trained for occupations for which their previous experience has given them some mechanical aptitude.

Farm Supplies

CONCERTED action is being taken by farmers to spur the Government on in the matter of rural electricity supplies, but the Ministry of Transport has shown itself well able to deal with this "impatience." Last July an inquiry was held at Evesham and as a result the Council was informed a few weeks ago—after nine months—that the further extension of supplies in rural areas was to be considered in the new Bill to be introduced by the Government. When the subject of rural supplies was raised in the House of Commons last week the Minister gave a similar reply, with the addition that, in the meantime, he would be pleased to arrange for the circumstances of particular cases to be investigated. From this, if the experience at Evesham is any guide, those who are hoping for the early extension of electricity supply to many rural areas will derive little satisfaction.

The Appointed Day

THE Minister of Transport has announced that the "appointed day" mentioned in the 1936 Meters Act is to be July 1st. On that day the Electricity Commissioners will appoint "a sufficient number of competent and impartial persons" as meter examiners. These examiners will presumably commence their duties immediately, and any meters installed subsequent to July 1st will require to be certified as "proper meters for ascertaining the value of the supply." Likewise, electricity supply authorities will be required to have arrangements in force for the examination, testing and regulating of meters.

Rate Relief

THIS is the time of year when municipal finance committees seeking to balance their accounts without incurring the odium attaching to increased rates cast covetous looks upon electricity department surpluses. Although restricted somewhat by the provisions in Schedule 5 to the 1926 Act, they are still able to filch large sums from their electricity undertakings. In this way the citizen who happens to be a user of electricity pays his own rates, his share of the electricity department's rates and a third instalment by way of rate relief. Of course the electricity departments themselves are largely to blame for this. They should reduce their prices to the consumers and not make such large surpluses—if they can get their Councils to pass their estimates in the first place.

[Elec. Rev. photo.

From the electrical point of view (as well as that of the public) the elaborate lighting arrangements are the principal attraction of the Empire Exhibition at Glasgow, opened by H. M. The King on Tuesday. The exhibits also include a great deal of electrical interest

THE electrical industry has special reason to be proud of its part in the Empire Exhibition which was opened by His Majesty the King at Bellahouston Park, Glasgow, on Tuesday last. Not only is there a good collection of electrical exhibits but electricity is an essential factor in the make-up of the whole show. It will need only a little well-directed publicity to render its acceptance by the popular mind as an "all-electric" exhibition.

All the buildings and other features in the 175 acres of the exhibition appear to have been designed especially with a view to effective lighting and the result is a night scene unparalleled by any previous effort of the kind in Great Britain. The Wembley Exhibition of 1924-25 had some excellent illuminations but much has happened since then by way of floodlighting, discharge lamps and neon lighting, apart from the general advance in technique and in the general conception of lighting possibilities, all of which ideas are crystallised at Glasgow.

Broadly, the Exhibition centres round a main avenue in the middle of which is an ornamental lake. The Palaces of Engineering and Industries, symbolic, it seems, of electricity's production and service, face one another at opposite ends of this avenue which is lined with flag-poles on either side equipped with dual-purpose lighting fit.-tings. Open at the top and closed for diffusion at the bottom these fittings each carry two narrow-beam projectors for up-light and a ring of m.f. lamps for down-light.

H.M. the King, accompanied by the Queen, declaring the Exhibition open on Tuesday last

In other main avenues and at such prominent points as around the band-stand there are inverted lighting fittings. According to their height from the ground these have two or three tiers of lighting lamps concealed in a bowl below projecting on to the under side of another bowl above for downward reflection. There is a third main class of "street lighting." The side avenues are served by fittings with two enclosed opal cylinders horizontally disposed in line on either side of the standard.

Inverted-bowl "mushroom" fittings illuminating flower-beds and lawns are surmounted by coloured enclosed spherical units—a really attractive idea. Without the spheres and with somewhat larger bowls similar equipments line the stairways on either side of cascades down the hill on opposite sides. With their three sections of five steps each, conveying the water as it is illuminated by colour-sprayed lamps, controlled for colour mixing and changing, behind the glass lips of the steps, these cascades by their beauty make one forget the effort of climbing up the hillside. At the top of each section is a white floodlighted horizontal fan jet with a fascinating appeal, but dignity is afforded to the whole display by floodlighted pylons centrally disposed up the cascade. To state that lighting to a total of 117 kW is used in the cascades may help the imagination to picture the effects mentioned in these inadequate notes.

From the north cascade steps one looks back at the intricacy of varying jet formations with colour-changing light of a fountain at the foot. Submerged in the 50-ft. basin are an outer ring of 40 three-unit rectangular floods, a similar number disposed as spokes of a wheel and a cluster of 40 projectors nested in the maze of water nozzles at the centre. There is a fitting note in the fountain in the approach to the Palace of Engineering, partly due to the massive projecting nozzles and partly, perhaps conjointly, to the symmetry of design. Two basins are arranged concentrically while a third half-encircles the outer concentric. There are eight large projectors at the centre of the inner basin, 32 smaller ones in an outer ring in the same basin, 40 in the outer basin under the lip of the inner basin, 17 banks of four projectors in the half-circle basin projecting on to outward jets and about 45 units under the lip of the outer basin.

But perhaps the last word in submerged lighting is that of the lake which is about 450 ft. long and 50 ft. wide. Three fountains —two flare and one pool—are spaced along the centre line. Each flare fountain is floodlighted by 16 projectors submerged in the basin while there are eight units around and outside the basin. The pool fountain has 72 units in its basin and 50 around it. Two banks of 24 projectors—one submerged and one in a structure above ground—colour the pool jets, supplementing the lighting from the pool itself. In the lake itself there are 18 sub-fountains each lighted by four white and eight colour projectors.

The tower is as great an achievement in constructional engineering as in floodlighting, for while it is 300 ft. high it has base measurements of only 26 ft. by 24 ft. Balconies at the top afford striking views of Scottish scenery for 600 spectators. Floodlighting on all sides of the structure represents a load of 58 kW. We are not prepared to discuss here whether outward projection from a structure can be termed floodlighting, but it is a fact that the fittings with which the balconies are studded for outward projection are normal floodlighting units.

The tower, cascade, fountain and avenue lighting was provided by the General Electric Co., Ltd., and the lake and Palace of Engineering lighting by the Edison Swan Electric Co., Ltd. The pumping and jet equipments for the fountains and lake were supplied by Drysdale & Co., Ltd., the pumps being driven by E.C.C. motors.

Another part of the electrical "make-up" of the show which becomes readily evident to the visitor is the two tower lifts which were installed by Waygood Otis, Ltd. They each carry 20 passengers and have a 216-ft. travel at a speed of 500 ft. per minute. Of the gearless type, they have car-switch control and the elevator motors are of 38 h.p.

In many other ways electric lighting is playing an essential part, not only by way of lighting the buildings inside and out, but in actually providing the means to display thousands of exhibits. In the Highland Village, for instance, there is an excellent realistic floodlighting effect on the mountain and lake scene. In the Government Pavilion a vast globe of glass and steel "floating" in starlit space is lighted from within, half dimly and half brightly to give a day and night effect as it revolves. Many photographs shown in such places as the Colonial, India and Ceylon and East Africa pavilions, display their illustrations with marked effect by the cubicled lamps behind them.

The Electrical Exhibits

To meet the needs equivalent to the requirements of a city of 500,000 "population" there is a distribution system which incorporates ten sub-stations and twenty miles or so of underground cable. And the largest, shall we say, "bulk consumer" is the Palace of Engineering, where there is abundant interest for the electrical visitor.

The Glasgow show seems to have answered many criticisms often levelled at heavy-engineering because of its poor representation at electrical exhibitions. From this point of view the exhibition may be considered as one of the models, but there is considerable actual heavy plant. Babcock & Wilcox, Ltd., for instance, are showing an actual portion of the front and side walls of a 500,000 lb. per hour Bailey hopper-bottom boiler furnace, as well as a complete No. 28 chain-grate stoker for a 60,000-lb. boiler.

There is an interesting comparison of old and new in the display by Mirrlees, Bickerton & Day, Ltd.—the first Diesel engine built in this country, single-cylinder (12 in. diameter) 20 h.p., and a six-cylinder (8 in. dia.) 360-h.p. set—both occupying about the same floor space. Butters Bros. have the machine element of a 3-ton 2-motor (5 and 15 h.p.) derrick crane, lifting, 50 ft. per min., slewing 400 ft. per min. and derricking 220 ft. per min.

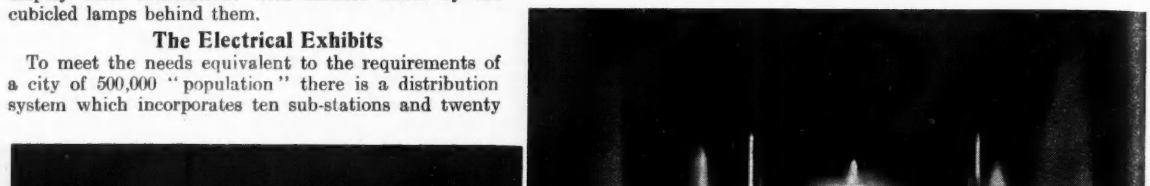
International Combustion, Ltd., is displaying a mechanically vibrated screen with a wide range for coal or rock from ¼ in. to 10 in. Coupled with this there is a "Hummer" magnetic screen for finer materials, incorporating a Westinghouse metal rectifier. There is a striking selection of heavy-duty motors by Bruce Peebles & Co., Ltd., while the way in which the General Electric Co., Ltd., have "put over" industrial applications for motors is compelling indeed. Traction, marine, colliery and steelworks motors are each displayed in a specially designed stand which carries also white cast models of an appropriate "working," for instance, a colliery head and a blast furnace.

We should say that the model likely to create the most interest is that of the new 54,000-kW, 3,000-r.p.m., two-axis turbo-alternator set installed at Brimsdown A. It is believed that this has been on load test. Glasgow electricity undertaking has on show models of the complete 237,500-kW Dalmarnock power station, of the 50,000-kW Parsons turbo-alternator in the same station and of the Nursling grid sub-station. A model of the Tongland grid "sub" is shown by A. Reyrolle & Co., Ltd. It incorporates the only example of 132-kV metal-clad switchgear in this country.

Perhaps the greater significance of the model of an impregnating plant as installed in the works of British Electrical Repairs, Ltd., lies in the apparent need for information on this class of work, judging from the number of inquiries received by our Service Department. Mavor & Coulson are showing models of two conveyor systems, one depicting the ease with which conveyors carried on the company's troughing can be built into structures and a system in a permanent gantry.

The diorama, the model so designed as to give natural perspective, is made good use of, too. That of the complete Galloway hydro-electric power scheme on the stand of the English Co., Ltd., is certainly an outstanding example. A diagram with a special appeal to both the generating engineer and the schoolboy is the M-V power station lay-out with 32 push-button points, each of which illuminates an appropriate picture in colour.

Amid this wealth of illustration by model and diorama the value of the well-displayed photograph and drawing stands as high as ever, and from this point of view the electrical exhibits seem appropriately to centre round the stand of the Electrical Development Association, where murals and large-

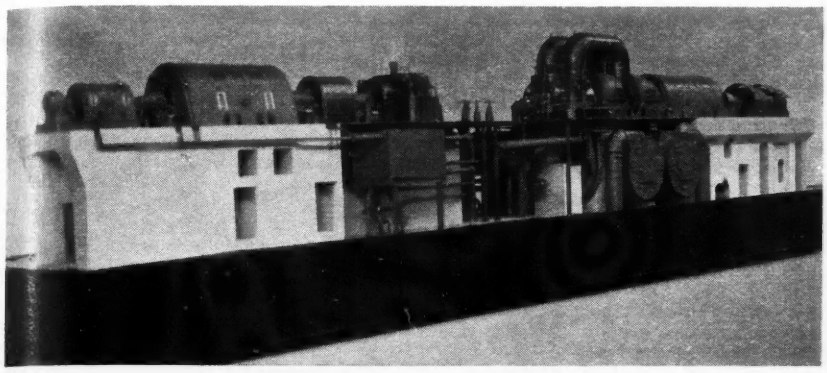


Some of the beautiful lighting effects

(1) Illuminated lake and fountains. (2) The grand staircase and Tower of Empire. (3) The I.C.I. building

scale photographs depict the progress of electricity in all industries and phases of life.

One particular aspect of the educational value of the exhibition with an appeal to both the engineer and layman is with regard to the display of constructional work by "cut-aways." For instance, a fine display of feed-water regulating equipment by G. & J. Weir, Ltd., shows readily the operation of "Robot," "Mumford" and steady-flow units and of high- and low-water alarm equipment. Again, there is a most interesting comparative display of motor rotor construction by the Macfarlane Engineering Co., Ltd., while in the Government

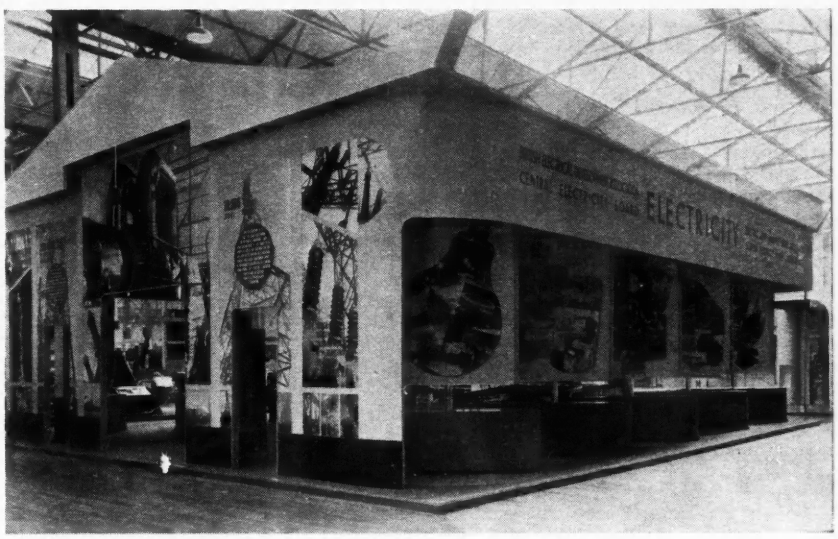


Model of the new 54,000-kW set at Brimsdown (North Met.) power station

Pavilion the construction of arc and high-frequency furnaces is shown by model and the neon tubing.

The electric motor stands supreme. Where it is not an actual exhibit it is driving one. The exhibits range from the variety of heavy machines such as the Bruce Peebles display to, say, the $\frac{1}{6}$ h.p. English Electric capacitor motor with built-in thermostat control. Traction is represented to some extent, and to point to just one representative example there is the English Electric tramway type controller which provides series-parallel control for two 80-h.p. motors or for four 40-h.p. motors. But perhaps the biggest appeal generally under this heading is likely to be the town coupé electric private car, introduced by Partridge Wilson & Co. ,Ltd.

The amount of welding equipment exhibited indicates the increasing value of this development to the electrical industry, and three units displayed by British Insulated Cables, Ltd., depict the trend of development. There is a continuous spot welder in which the power-driven electrode automatically opens and closes; a new pencil-type spot welder designed so as to gain access to confined spaces (say, railway carriages); and a power-driven butt welder for tubes in which the upset is first adjusted by hand levers and the pressure is applied by motor. J. H. Holmes & Co., Ltd., have a single-operator a.c.-d.c. set with a maximum capacity of 300 A, while on the Metropolitan-Vickers stand we saw an atomic hydrogen set by which



Large well-displayed photographs and murals on the E.D.A. stand depict many electrical applications

demonstrations are given in a special observation room.

The outstanding example of conversion equipment is probably the comprehensive range of both hot-cathode and mercury-pool rectifiers shown by the British Thomson-Houston Co., Ltd., including a 400-V, three-phase glass-bulb and cubicle industrial equipment with a d.c. output of 400 A at 250 V.

Excluding the smaller "accessories" type of equipment, switchgear has a fair representation in a range from the 132-kV ironclad-unit model already mentioned to distribution fuse equipment such as the "Z" fusegear of Siemens Electric Lamps & Supplies, Ltd., and the "Warwick" gear of Wm. McGeoch & Co., Ltd. Perhaps the most interesting comparative display of lower voltage switchgear is that by M. & C. Switchgear, Ltd. An industrial cubicle switchboard about 7 ft. long has eight feeder units and takes roughly the same floor space as an equivalent metalclad equipment with four units.

Apart from a comprehensive display of new products of Scottish Cables, Ltd., cable developments are more evident by some stringent testing demonstrations. Pyrotenax, Ltd., have some of their new copper sheathed fire-resisting cable operating in boiling water, over a hot plate and in molten metal. The controls of the 11-kV Reyrolle switch are wired with this cable, by the way.

Apart from a few spectacular displays, the standard lighting exhibits are centred in the E.L.M.A. revolving stand with its many types and makes of lamps displayed, and in the panels of attractive designs constructed entirely of coloured architectural lamps. The Curtis Lighting Co., Ltd., has a comprehensive range of indirect commercial and industrial equipment, and the McGeoch heavier type of protected apparatus is a valuable contribution to the lighting section. "Brytal" non-tarnishable reflectors displayed by the British Aluminium Co., Ltd., depict the process used for the Exhibition floodlights.

A wider use of fluorescent lighting is indicated by several makers, and the two broad applications of the phenomenon are depicted by Siemens. There is the "Sieray" lamp in which fluorescence counteracts the deficiency in red rays of mercury-vapour light and the ultra-violet lamp which reacts on treated materials. Spectacular demonstrations of the latter are the G.E.C. cave and a B.T.H. display cabinet. The treated materials in both cases are compared under ordinary and u.v. lighting with striking results. In the B.T.H. street- and industrial-lighting equipment there are units with fluorescent inside-coated bulbs. In the I.C.I. Pavilion dyestuffs are suggested by colour patterns shown through fluorescent light. Neon-lighting possibilities are stressed by Claude-General Neon Lights, Ltd.

There is something, too, for the research worker, a quarter-million volt continuously-evacuated X-ray tube and a working 300,000-V impulse generator by Metropolitan-Vickers, and a self-contained tensile, compression and bending steel-testing machine by W. & T. Avery, Ltd., and a pH (acidity or alkalinity) tester and recorder by George Kent, Ltd.

When discussing the air-conditioning installation and the room it serves exhibited by Thermo Tank, Ltd., it was pleasing to hear the emphasis given to the fact that an air-distributing unit was not regarded as air-conditioning plant.

From the broader view of public appeal the chief interest in connection with the domestic displays lies in the provision for demonstrations. The G.E.C. has a very attractive theatre for this work, and one end of Carron Company's stand is laid out to seat about 30 people. Moffats, Ltd., have a stand arranged as a planned kitchen. The English Electric and the Hotpoint Electric Appliance Co., Ltd., have comprehensive ranges of cookers, water heaters and fires, and there is a goodly display of refrigerators by the Pressed Steel Co., Ltd.

Directive Radio-Telephony

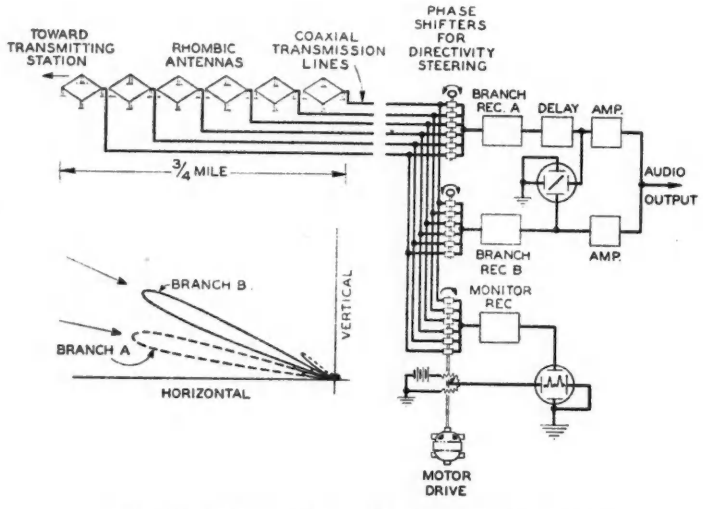
Recent American developments

In the course of a lecture before the Wireless Section of the I.E.E. on Wednesday, Dr. R. Bown described a multiple unit steerable antenna system for which he claimed remarkable directional qualities

THE lecture delivered in London on May 4th before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS by Dr. R. Bown (radio research director, Bell Telephone Laboratories, U.S.A.) commenced with an explanation of how sharper directional reception, but controlled in a novel way, is returning to prominence as a means of overcoming noise and distortion, two fundamental hazards to telephone transmission, which in short-wave long-distance service remain of serious proportions. They have their genesis in the vagaries of the transmission medium itself and so can best be mitigated by attack upon that part of the system.

Short-wave directive antennae had not long been in use before it was observed that the improvement they gave must be viewed as a statistical average rather than as a fixed value. This was evidence of variability in the angle of approach of the signal, and a warning that there were practical limits to the sharpening of directivity.

A system known as a "musa" (multiple unit steerable antenna) had been developed by Messrs. H. T. Friis and C. B. Feldman and their associates at the Bell Telephone Laboratories which employed six horizontal rhombic antennae, arranged in a linear longitudinal array and connected by coaxial lines to six phase shifters whose outputs were combined. The phase shifters were mechanically geared together in such a way that by turning a single control the sharp directivity given by the array could be aimed at any desired vertical angle within the range of the unit antenna characteristics. The array was so sharp that it might be steered to select one incoming signal ray from another and in this way to receive only signal components of about the same arrival time.



Simplified diagram of experimental "musa" system

The antennae fed, in parallel, three separate phase shifter groups, so that three independent outputs, steered for three different receiving angles, might be secured simultaneously. The output from each such branch was subject to considerable fading, but it was much less selective fading than occurred with an ordinary directive antenna. For combining the outputs of the two branches, to gain the advantage of diversity, it was sufficient merely to introduce an audio-frequency delay into the branch receiving at the lower angle, to adjust the value of this delay until the two audio signals were in phase, and then to deliver them both to a common output.

Two definite improvements obtainable by musa receiving were (1) the sharp directivity of the receiving branches excluded noise not arriving at the same angles as the received signal components being selected; (2) the separation of the differentially delayed waves and the correction of delay before the components were permitted to combine, reduced selective fading and distortion. In the experimental system at Holmdel, New Jersey, 7 to 8 db improvement in signal to noise ratio was realised and the reduction in distortion was frequently quite marked.

There was a suspicion that the difficulty lay, not in unusual behaviour of the wave paths in the vertical plane, but in anomalous performance in the horizontal. At times of severe and very fast (flutter) fading observations indicated a shower of wave components scattered through a considerable range of angles around the great circle direction to the transmitter. Striking data were being secured with a musa broadside array of receiving antennae arranged for sharp steerable directivity in the horizontal plane. In this work the Rugby station of the British Post Office and the British Broadcasting Corporation's at Daventry were co-operating.

When there was darkness, or partial darkness, on the intervening space, the great circle route no longer provided the sole transmission path. Frequently waves arrived at other azimuths. In a considerable number of instances it had appeared as though the ionosphere were warped, there being definite shifts of the direction of wave arrival. In magnetically disturbed evening periods great circle paths appeared to be attenuated so much that more southern routes often seemed to provide the principal means of transmission. Although southern paths were usual, they are not always predominant. In the severe magnetic disturbance of January, 1938, marked southern deviations occurred as the magnetic storm developed, and as it receded, but for the period of its greatest intensity a somewhat northerly path was much the most prominent.

While theories had been formulated, it was too early to draw practical conclusions. But there was a strong implication that wide range azimuthal steering of both transmitting and receiving antennae promised to improve transatlantic circuits during afternoon and evening hours, particularly when the ionosphere was abnormally disturbed.

Speech Controlled Devices

Turning to a still older principle, Dr. Bown discussed methods which modified the amplitude characteristics of the speech signal at voice frequencies. For example, the "compandor," which had operated successfully for some years on the New York-London long wave circuit, comprised two pieces of apparatus. A compressor at the transmitting end was a voice amplifier with a fast-acting automatic gain control, which smoothed out the speech syllable by syllable and reduced or "compressed" to one half (as measured in decibels) the range of amplitude variation of signals passing through. At the receiving end, the "expandor" had a sort of *negative* automatic volume control action which doubled (in decibels) the range of variation of signals passing through it. It expanded the speech signal to its original volume range.

Since the action of the expandor was controlled by the variations of the received speech signal itself rather than by a separate pilot channel, spurious changes in intensity caused by fading could not be distinguished from real signal characteristics and would therefore be exaggerated also. For this reason the expandor had not been applied to short wave circuits. A compressor alone was of some value, but had not been so applied commercially. The expander, used alone at the receiving end, had a beneficial effect and was sometimes called a "noise reducer" when employing marginal characteristics.

The volume limiter curbed excessive upward variations, but as ordinarily used had no effect upon undesirably low volumes. One device which accomplished both these things had been called a "vogad" (voice operated gain adjusting device). It had two interlocked control circuits. One sampled the input speech, and if the volume was low it raised the gain. The other control sampled the output speech, and if the volume was up to the desired level it disabled the operation of the first control circuit. If the output volume was too great the second control circuit acted further to decrease the gain.

Dr. Bown said that single sideband transmission was one way of reducing noise and distortion in short wave telephony which was destined to be of increasing importance, though there was some divergence of the method of handling the carrier frequency. For multi-channel working he considered it desirable to try to use more closely packed grouped channels. In this connection he examined the significance of intermodulation between channels, mentioning the two- and three-channel arrangements tried out on the Netherlands-Java circuit, and the twin channel system being tested between New York and London, as examples of progress along this line.

Air-dielectric Cables

By E. W. Smith, Ph.D., B.Sc.(Eng.), M.I.E.E.

Several interesting types now in production are described. One of the latest combines the disc-spaced and tube-insulated constructions, a notable use for this easily handled cable being to connect the transmitter with the aerial in outdoor television

A RAPID extension of the frequency range of cable transmission has taken place during the past few years. Limited not long ago to carrier frequencies of about 30 kc., it has recently of necessity been extended to include frequencies up to that required for television, that is, to at least a megacycle. It was only natural that the solution of the problem of providing for this extension should be sought in the use of air as the greater part of the dielectric.

Dry air is ideal where high breakdown strength is not of paramount importance—the best known form of solid insulation giving transmission losses at least 50 per cent. higher—

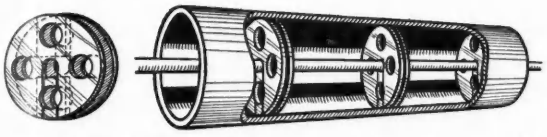


Fig. 1 (left).—Synthetic spacing disc. Fig. 2.—Section of cable after the lead sheathing process, with the sheath cut away to show the centre conductor and spacing system

and it has been found possible to approach so closely in practice to the ideal of a dielectric entirely composed of air that the high-frequency cable is not limited in frequency range to even a megacycle, but can be used, in lengths of several miles, for frequencies as high as 50 Mc.

At the same time, air dielectric types of cable have been developed for auxiliary wiring, so that in all cases where high-frequency energy is confined to wired circuits a special air dielectric cable is now available to take the place of the less efficient conductor insulated with solid materials.

The three chief types of high-frequency cable may be classified according to the means adopted for keeping the conductors separated in the surrounding air, referring particularly to the coaxial construction. The chief methods of separation are (1) by insulating discs disposed laterally on the centre conductor at regular intervals along the length of the cable; (2) by open helices of insulating material wound continuously round the centre conductor; and (3) by insulating tubes in which the conductor is centred either by regularly spaced lateral constrictions or longitudinal ribs in the tube, or by kinks in the conductor itself. In general, the first type has the advantage of requiring the least amount of solid dielectric.

The cables manufactured by the Telegraph Construction & Maintenance Co., Ltd., are of types (1) and (3). The former type has been developed in association with Marconi's Wireless Telegraph Co., Ltd., and is based on one of the earliest patents for disc-spaced cables, *viz.*, British patent No. 284005 (C. S. Franklin). Details of the present construction are disclosed in British patent No. 470760.

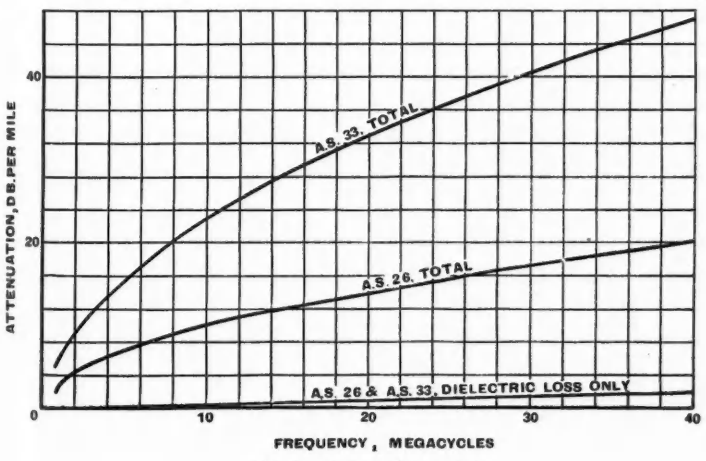


Fig. 3.—Attenuation curves

Disc-spaced (Type 1) cable has a solid copper wire as centre conductor, spaced within a lead tube as outer conductor. The spacing discs, which are a special feature of the construction, are moulded of the synthetic transparent resin known as Troiitul. This material has a dielectric constant of about 2.5 and a power factor of 2×10^{-4}, these figures being by far the lowest now obtainable with this class of material. Trolitul also possesses the important advantage of being non-hygroscopic, and extended observations have shown that its electrical and mechanical properties have no tendency to change with time.

The discs (fig. 1) are designed for assembling in pairs, each having a slot to pass the conductor, and a raised rib of the same dimensions as the slot, along the opposite radius thereto. In the assembly the pairs are cemented together and to the centre conductor, so that the rib of one disc fits into, and closes, the slot of the other. A light and rigid spacing unit consisting of the minimum amount of a high quality dielectric is thus formed.

The longitudinal spacing between pairs of discs is normally 3 in. Continuous lengths up to 500 metres are readily accommodated on suitable drums, and after the assembly is complete the outer conductor, which consists of a lead tube some 80 mils in radial thickness, is directly extruded over the discs from a lead press.

The melting point of the discs is sufficiently high to prevent softening during the short time that they are under the plastic lead, and special blocks of reinforced discs are assembled on the conductor at pre-determined and marked intervals to enable the lead press to be stopped and recharged as required. There is thus no practical limitation to the length of cable which can be sheathed in one operation, although it has been found convenient in manufacture and in subsequent handling to limit the length to about 500 metres.

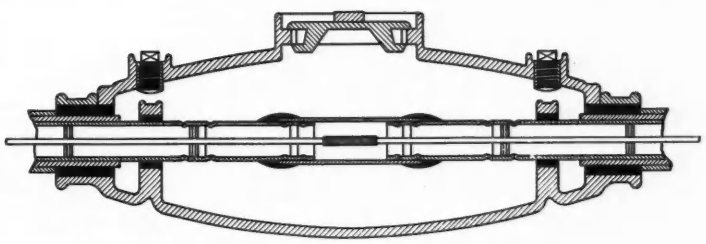


Fig. 4.—Straight-through joint box for burying direct in the ground

A section of cable after the lead sheathing process, with the sheath cut away to show the centre conductor and spacing system, is shown in fig. 2. The cable as described is normally provided with double steel tape armouring, which, with jute servings and compound, protect it adequately for installation direct in trenches. The illustrations show the cable known as A.S.26, this being the most commonly used size. A smaller size, A.S.33, is manufactured in a similar manner. These two cables are designed to have the same impedance, so that they may be interconnected without reflection losses, the larger (armoured) being normally used as the main cable and the smaller (unarmoured) being connected thereto for internal distribution.

Dimensions and Electrical Data

The table on page 642 gives details of the size and attenuation of these cables.

The attenuations are illustrated in fig. 3, which also shows the very small proportions due to dielectric loss.

The average capacity of a large number of manufactured lengths of A.S.26 cable is 0.0540 μF per mile. This corresponds to an effective dielectric constant of 1.07. The measured power factor of the cable has never exceeded 5×10^{-4}, so that the ideal of an all-air dielectric has been very closely approached. These cables have now been installed in radio receiving stations at home and abroad. In the new Swedish receiving station at Enköping, for example, about 5 kilometres is used for con-

necting the aerial array with the indoor receiving equipment.

SIZES AND ATTENUATION.

	A.S.26.	A.S.33.
Diameter of inner conductor	0.128in.	0.064in.
Inner diameter of outer conductor	0.75in.	0.375in.
Outer ,, ,, ,, ...	0.91in.	0.515in.
Approx. characteristic impedance, ohms ...	100	100
Attenuation, db. per mile at 2 Mc.	4.5	9.5
,, ,, ,, 10 ,, ...	10	23
,, ,, ,, 20 ,, ...	14	33
,, ,, ,, 40 ,, ...	20	47

A series of jointing and terminating fittings are available, examples of which are illustrated in figs. 4 and 5. The former sketch shows in section a straight-through joint box for burying direct in the ground, and the latter an end-terminating gland in which the inner and outer conductors are gripped by a taper plug in a gland having a tapered opening. It may be noted that, although primarily designed as a receiving feeder, A.S.26 cable has been found capable of transmitting 8 A at 21 Mc.

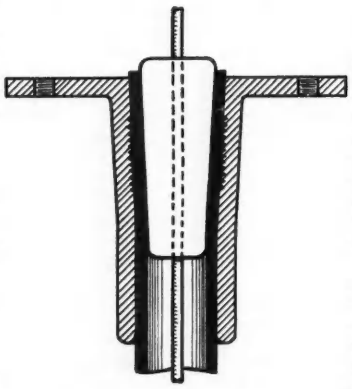


Fig. 5.—End-terminating gland in which the inner and outer conductors are gripped by a taper plug in a gland having a tapered opening

Tube-insulated Type

In considering the tube-insulated (type 3) h.f. design one may recall that in about 1890 the Telegraph Construction & Maintenance Co., Ltd., developed a cable in which gutta-percha was extruded round the conductor in such a way as to leave hollow channels within the insulating envelope. This type was laid as a submarine cable across the Solent in 1897 and the Irish Sea in 1900 and 1904. Its limited use was due to the fact that the initial low capacity of the cable was not maintained under the hydrostatic pressures to which it was subjected after installation.

The modern construction is illustrated in fig. 6, the improved materials now used being specially purified gutta-percha and "Telconax," both thermoplastic compounds. These have dielectric constants of 2.5 and 2.9, and power factors of 10×10^{-4} and 50×10^{-4}, respectively.

The former is extruded round the centre conductor in the form of five narrow longitudinal ribs, the cross section being star-shaped as shown. A tube of "Telconax" is then extruded over this unit, and forms a smooth continuous exterior over which the return conductor is applied as a wire braid. Special gutta-percha is used where its superior electrical qualities and its mechanical strength are taken full advantage of, while the "Telconax" tube protects the star-shaped spacing unit and makes the cable highly resistant to moisture, chemicals, sunlight and other deteriorating influences.

One of the great advantages of tube-insulated cables is their flexibility, and the type just described, known as A.S.5, is as flexible, and may be handled as easily, as a solidly insulated cable of the same size. Another notable feature is that it may be readily incorporated in multi-core cables. One of the standard types manufactured is a screened twin cable which has found considerable use as a dipole aerial feeder. This type, known as A.S.12D, is shown in cross section in fig. 7.

Cables A.S.5 and A.S.12D. have impedances of approximately 100 and 200 ohms, respectively, and attenuations of about 10 db. per 100 yd. at 44 Mc. Other sizes having lower impedances are also now in production.

Combined Construction

It has recently become practicable to combine the two types of construction described in the production of cables possessing the low attenuation of the first and some of the flexibility of the second. In this construction the centre conductors of A.S.26 or A.S.33 cables, complete with spacing discs, are enclosed in a tube of "Telconax" of some 70 mils radial thickness. On the outside of this smooth covering is wound a return conductor consisting of a number of thin copper tapes. These are applied with a long lay, and cover the "Telconax" surface almost completely, thereby furnishing a return conductor with characteristics closely approaching those of a thin copper tube.

Another "Telconax" tube is extruded over this composite return conductor, giving a tough waterproof finish to the cable. These types, A.S.26F, and A.S.33F, have rather lower attenuations than the corresponding cables with lead outer conductors, A.S.26 and A.S.33. They are light and easily handled, and one of their uses is for connecting the transmitter with the aerial in televising outside events, where rapidity and ease of erection are important factors.

Mention may be made in conclusion of interesting work in connection with the development of a large air-space transmitting cable. In this case the centre conductor is a ½ in. copper tube and the spacing discs are of a low-loss ceramic material 2½ in. in diameter. This cable, known as A.S.34, has an impedance of 95 ohms and will transmit 36 amps at 21 megacycles. While it can hardly be designated "flexible," it can be made in appreciable lengths and transported on drums and installed similarly to a solid dielectric cable of the same size.

Fig. 6 (left).—Modern construction of tube-insulated h.f. cable.
Fig. 7.—Cross section of screened twin type

Radio Wave-band Decisions

THE International Telecommunications Conference, which was held in Cairo from January to April this year, was attended by 710 official delegates and the Governments of about seventy countries were concerned with its deliberations.

The conference dealt with many things relating to telegraph, telephone and radio services. One of its last tasks was to modify somewhat the wave-bands employed for wireless services, mainly by way of widening the bands employed, especially in the higher-frequency ranges. These changes will not become effective until September 1st, 1939.

The Conference has not allocated any wave-lengths to particular stations, but it has charged the Union Internationale Radiotéléphonique with the formulation of a "new Lucerne plan" whereby an effort will be made to obtain an entirely new allocation of wave-lengths for broadcasting purposes. If approved (at another conference to be held before February 1st, 1939, in Switzerland), the new allocation will become effective six months later and, at the same time, an attempt may probably be made to modify the power of certain stations.

How the changes made at Cairo affect broadcasting and television services was explained by Sir Noel Ashbridge, controller of engineering, B.B.C., at a gathering on Monday of this week. The long-wave bands (derogation and regulation) between 150 and 431 kc. remain unchanged. To the medium bands from 519 to 1,500 kc. there has been added a 60 kc. extension (downward from 200 to 192.3 m.). A new set of intermediate wavebands has been established between 2,300 and 4,965 kc. for the assistance of broadcasting in tropical and semi-tropical countries (between 30 deg. N. and 30 deg. S.). These are intended more for local use than for truly short-wave services over long distances.

Most of the changes have been made in the short wave-bands, as follows: 6,000 to 6,150 kc. extension to 6,200 for relieving congestion in winter. A quite new 7,200 to 7,300 kc. band has been established for all regions (except the American continent), which is to be shared with amateurs; 9,500 to 9,600 kc. extension to 9,700. There is no change in the 11,700 to 11,900 kc. and 15,100 to 15,350 kc. bands; the 17,750 to 17,800 kc. band is extended to 17,850. The 21,450 to 21,550 kc. extension to 21,750 is not of immediate importance, but will be useful for overcoming sun-spot interference during the next period of solar activity. The 25,600 to 26,600 kc. band which is not much used remains unchanged.

The ultra-short wave-band, which includes television frequencies, has not hitherto been specified. Contrary to expectation, a definite demand for allocation was made at Cairo and so the following four bands have been established: 40.5 to 58.5 Mc. to accommodate three stations; 64 to 70.5 Mc. for one station; 85 to 94 Mc. for 1.5 stations, and 170 to 200 Mc. for five stations.

Although no frequency band lower than the first (6,000 to 6,200 kc.) has been allocated for long-distance broadcasting, Great Britain may utilise, by agreement with America, a frequency within a band of the order 3,500 to 4,500 kc. (85.7 to 66.67 m.) for transatlantic broadcasting in the exceptional period when the sun-spot cycle renders the higher frequencies ineffective.

The Cooking Peak. By V. G. Clark

Its effect on costs in some smaller towns

THE leading article in the ELECTRICAL REVIEW of February 11th raised the question of whether an increase in the domestic peak over the lighting-power peak might not cause the low rates now charged for the former to become uneconomic in the future. The experience of a typical medium-sized undertaking may be taken to illustrate the possibilities in this connection.

Ashford, Kent, has fostered the use of electricity for all domestic purposes, and, besides offering attractive tariffs, has provided apparatus on hire at less than cost and has made it easy for the consumer to obtain it without formality.

The secondary rate of the two-part tariff was fixed at ¾d., as it was realised that, in regard to the cooking load, it was unnecessary, and also uneconomic, to go lower. The number of pieces of apparatus connected justifies the first statement; the second is supported by the considerations discussed below.

A Question of Finance

In the first case, the assumption is made that the peak load is not affected by the cooking load. An average size of cooker, with two hotplates, costs the undertaking about £9 10s., including installation, the control switch and wiring. The period of repayment fixed by the Electricity Commissioners is seven years. At 3½ per cent. the annual loan repayments are about £1 10s., but such a cooker is hired to the consumer at £1 4s. per annum.

The domestic load can no longer be regarded as a kind of by-product of the electricity supply industry. In the future it will tend to become more and more the mainstay of many undertakings

The fixed charge of the two-part tariff is neglected, as this would be paid whether a cooker were installed or not.

The average annual consumption of a cooker is somewhere about 1,000 kWh, but it is difficult to obtain a correct figure as many consumers have fires and other apparatus on the same meter. However, where a cooker only is installed the average consumption is definitely less than 1,000 kWh.

The running charge under the C.E.B. tariff is 0.21d. per kWh, which the increase in cost of coal has brought up to 0.25d. Adding local rates, Electricity Commissioners' expenses and other charges to the undertaking, based on kWh sold and allowing 15 per cent. distribution loss, the minimum cost to the undertaking of each kWh sold comes to about 0.4d. Thus the annual expenditure incurred per cooker may be taken as £1 10s., capital charges on the cooker, plus £1 13s. 4d. for 1,000 kWh at 0.4d., making a total, without maintenance, of £3 3s. 4d. The income is made up of £1 4s. hire charges and £3 2s. 6d. for 1,000 kWh sold at 0.75d., yielding £4 6s. 6d.

At ½d. per kWh the income would be £3 5s. 8d., leaving very little surplus for repairs and maintenance, even if the tenant were to keep the cooker for the whole seven years without changing it for another size, which often happens Change of tenancy also usually involves expense in removing, cleaning and reinstalling a cooker. If the cooker has been ill-used it may even have to be hired at reduced rates in order to get it into use again. The average cost of maintenance is certainly higher than the 3s. 11d. given by Mr. J. N. Waite in his recent I.E.E. paper.

Although at ¾d. per kWh there would be an ample margin, the cooker load is not entirely clear of peak loads. The theory that diversity between domestic and power loads actually improves the overall load factor is certainly true up to a point. The load factor at Ashford has risen from 23 per cent. in 1928 to nearly 40 per cent. in 1937, in some measure due to judicious load-building, but probably also due to this diversity.

The Optimum Value Reached?

But will this tendency continue? Indications at the moment are that the optimum value has been reached and that diversity will probably decline in future years. The morning peaks during the half-hours ended 8.30 a.m. and 12 noon have now grown to such an extent that they exceed the "lighting" peak, which has usually formed the basis of tariffs. It is anticipated that the morning peaks will continue to grow at a greater rate than those for the rest of the day. In three years the two morning peaks have increased by approximately 100 per cent., while the 5 p.m. lighting-power peak has increased by only 62 per cent. Both morning peaks are about equal.

The chief causes of the first peak are the popularity of the electric fire for breakfast-room heating and the use of the cooker for preparing the meal. The midday peak is, of course, due to the preparation of the hot meal usually served then in an industrial town. (Incidentally, the Monday peak at noon is considerably less than on other days.) The cooker makes its highest demand before the meal is cooked and is often switched on before the power load has ceased. Fortunately, the dinner hour is "staggered" to a certain extent, as the staffs of offices and business houses usually have a later period than those of the factories. What might occur if all midday meals needed to be cooked at the same time is indicated to a small degree by the occurrence of the highest peak usually on early closing day, *i.e.*, when there is no staggered dinner hour for shop assistants.

Effect on Load Factor

As the domestic peak now exceeds the lighting peak by only a small amount, its effect is not serious, but should the cooker load outstrip all other classes of load an adverse effect on the load factor and costs must be felt. This may not be a probable contingency in many areas, where various potential uses of electricity will influence the position, but there are other areas which have their largest openings in the domestic field.

Ashford is a fair example of many medium-sized undertakings as it comprises an urban area of 9 sq. miles, with 22,400 inhabitants, which is surrounded by a rural area of 85 sq. miles with a population of 11,360. It is a market town, with a few factories, the surrounding country being devoted chiefly to agriculture, although a number of quarries and brickfields provide a useful power load.

Gas is available in the urban area at 1s. per therm and in two of the villages only at 1s. 2d. per therm. The major part of the area is now cabled and supply given to 9,100 consumers out of a possible 10,850, of which 9,820 are either domestic premises, farmhouses or hotels, and 3,277 already have an electric cooker. Most of the shops, offices and factories are already connected, and the extra load obtainable from these is estimated at only 20 per cent. of the present load.

There is thus still wide scope for extension of supply to the domestic premises, even for cooking alone, so that this class of load will eventually determine the peaks and control the undertaking's costs. Already the cooking peak has outgrown the lighting-power peak, even while that itself has been growing. As the growth of the latter is likely to be curtailed shortly, capital charges will have to be taken into account in assessing the cost of supply to cookers.

The station load curves show that the peak load at the bus-bars due to cookers alone (in December) is in the neighbourhood of 0.4 kW per cooker connected to the mains. This, of course, has taken into account the full diversity of such load, which, being in the neighbourhood of 12, may be considered quite good. The peak would undoubtedly be higher were it not for the staggered dinner hour and also for the use in many households at that time of year of coal-fired ovens, the electric cookers being used only occasionally, if at all.

This means that for every household adopting electric cooking the morning peak will rise by 0.4 kW, while the evening demand at the 5 p.m. peak will probably be affected very little by it. With an annual consumption of 1,000 kWh, the bus-bar load factor is only 28.5 per cent. for this type of load. It seems likely therefore that unless other load compensates for this, the total load factor of the station will in future show a decline.

The Cost of Electricity

The kilowatt demand charge varies among undertakings, depending on whether the station is "selected" or whether the undertaking can buy at the grid tariff or receives its bulk supply through further transmission lines, and on which rate of "increment of demand" it can purchase. Ashford is, unfortunately, nearly fourteen miles from the grid sub-station whence its supply comes, and the average rate per kW of demand, including capital charges on and losses in the transmission line, is at present about £4 10s. This will decrease as the line becomes more fully loaded and as the next "increment of demand" is reached, but it will be about £3 5s. for every future kW demand made for a considerable number of years.

When the present number of cookers connected is doubled the morning peak is expected normally to exceed the evening peak by about 1,450 kW. If the present rate of installation continues this will occur nine or ten years hence, when the number of cookers will be 6,554. Assuming that the 5 p.m. peak kW charges are met by the load at that period, it means that the charge for the 1,450 kW excess must be borne by the cooking load; that is, 1,450 kW at £3 5s.=£4,712. If this amount is averaged over the 6,554 cookers the annual kilowatt charge per cooker will be increased by just over 14s.

This will result in a deficit where the charge is at ½d. per

kWh, but there will still be a small balance if the secondary rate is ¾d.

Up to this point, however, I have neglected costs due to mains and other apparatus which will undoubtedly be increased. Mains that are capable of dealing with a considerable amount of lighting load are often inadequate for maintaining a reasonable steady voltage for cooking. Quite apart from the Commissioners' Regulations, voltage must not vary too much if cookers are to give satisfaction.

Voltage Variation Difficulties

The most obvious reason for voltage variation is the high loading of the cooker compared with that of other domestic apparatus. The best that the mains engineer can do when installing service cables is to see that the premises are balanced as nearly as possible on the three phases. With lighting only one can be reasonably sure that at the evening peak most premises will be using the supply, and the resultant approximate balance will maintain a satisfactory voltage at the consumers' terminals.

With the cooking load, even though the houses in a street are equally divided on the phases, there is nothing to ensure that an equal number of consumers on each phase will install an electric cooker. This could be partly overcome by putting in three-phase four-wire services in a number of houses and choosing the most appropriate phase according to the loads on the main.

The Commissioners' Electricity Regulations do not prohibit such an arrangement, as Section 28 (a) applies to giving a supply from more than one phase if the connected load is less than 8 kW. This arrangement, however, needs extra expenditure on three-phase services, and continual adjustment as more cookers are added. These expenses are directly attributable to the cooking load.

Even then all the consumers do not use their cookers together, nor do they use every part of them. While this gives the good diversity experienced at the station bus-bars, it is bad for mains balance. Moreover, the diversity on a distribution main is found to be considerably less than the station diversity.

A Further Item of Expenditure

On one estate where complaints were received of low voltage the distance from the sub-station to any part of the estate was comparatively short and the services were well balanced. On investigation it was found that the cooker loading was not well balanced, and, furthermore, that each phase became loaded at different times. The voltage variation was corrected by the installation of a static balancer, requiring further capital expenditure on behalf of the cooking load.

Is not the lament that distribution has not kept pace in efficiency with generation partly due to the increased losses in the mains owing to heavier out-of-balance currents and to extra capital expenditure on more and larger transformers and mains to deal with the domestic peak? The domestic load can no longer be regarded as a kind of by-product, and in the future it will tend to become one of the main markets of electricity supply undertakings.

London J.E.A. Finance

Burden of capital charges

AT last week's meeting of the London and Home Counties Joint Electricity Authority Mr. M. H. Davis, chairman of the Finance Committee, presented a statement upon the Authority's financial position. In the course of this he said that the accounts for the nine months to December 31st, 1937, revealed a trading deficit of £67,948, of which approximately £46,000 was on account of the change by the Electricity Commissioners in the financial year, which now ends in December instead of in March. The accounts, therefore, did not include the revenue for the heaviest quarter of the year. In addition, these accounts and the estimates for the twelve months ending December 31st, 1938, provided for a "lag" in the collection of revenue of £85,000. Since the closing of the accounts this "lag" had been valued by the auditors, appointed by the Electricity Commissioners, as being over £115,000, an improvement of £30,000 upon the published accounts.

A Progressive Policy

The Authority supplied electricity directly to consumers in an area of approximately 200 square miles, extending from Twickenham, through Surbiton, Weybridge, Leatherhead, Sutton, Ewell and Dorking to the southern Surrey boundary. The undertakings operated were acquired in 1931-2 from six separate companies, the purchase price being approximately £2,000,000. This included practically total capital expenditure plus capitalised profits. At the time of acquisition consumers in this area numbered 37,000 with a total annual consumption of 25 million kWh. As a result of the progressive policy adopted by the Authority, the consumers now numbered 121,000 with an annual consumption of 150 million kWh. Eighty per cent. of these consumers were supplied on the favourable two-part tariffs introduced by the Authority. Over £3,000,000 had been expended during the six years' trading on developing the undertaking, upon hire and hire-purchase schemes, and upon extending electricity facilities generally. At December 31st, 1937, the total capital expenditure on the undertaking was £5,259,000.

Growing costs (particularly of coal and other materials) had compelled the Authority to consider carefully its financial position and the development of that position in the immediate future. This consideration had emphasised the fact that during the year 1938 out of a total revenue of £1,015,000 no less than £242,000 was required for the redemption of capital and £187,000 for interest on capital. The Authority considered that the period allowed by the Commissioners for the redemption of the capital was, in many cases, much too short and much less than the life of the assets represented by the expenditure.

The obligation to pay off so large a proportion of the capital within a period so comparatively short made it difficult for the Authority to show, for the time being, a surplus on its trading account without increasing its charges. For instance, capital expenditure of some £436,000 falls to be repaid within a period of seven years, and £513,000 within ten years from the date of expenditure.

Of a total capital expenditure up to December, 1937, of £5,250,000 no less a sum than £900,000, or approximately 20 per cent., had been taken from the revenue during the past six years for capital redemption. Assuming the present rate of capital expenditure and redemption of capital to be continued, it was estimated that by 1946 £3,825,000 would have been accumulated in sinking funds for the redemption of a total capital expenditure of £7,500,000. In other words, in 15 years' trading 50 per cent. of the gross capital expenditure of the Authoriy in 1946 would have been written down out of revenue. This was a much higher rate of redemption of capital than the average of comparable undertakings. At the same time the assets were maintained out of revenue in a state of complete efficiency.

Even with this high rate of writing down capital expenditure the Authority was satisfied that, at the present tariffs, the revenue would be sufficient to meet the expenditure on trading account, including redemption and interest charges, by 1942, but it had approached the Commissioners with a view to obtaining some relief from the necessity of writing down capital at so rapid a rate, particularly as the life of the assets concerned was considerably longer than the period allowed for the redemption of the capital. To this the Commissioners had, so far, not agreed, suggesting that the year 1940 instead of the year 1942 should be the datum year. The only alternative would be for the Authority to increase its tariffs, but the Authority did not consider it reasonable to call upon its consumers to bear the burden of such heavy capital charges and increased tariffs.

Increased Charges not Justified

In a recent interview with the Commissioners Mr. Davis had maintained that there was no justification for a general increase of tariffs; that the Commissioners should vary the loan sanction periods; that the existing loan sanction periods threw an undue burden of debt redemption upon the Authority by comparison with other public authorities; that if the high rate of debt redemption were taken into account there was no reason for a general increase in tariffs; and that a general increase in tariffs or a limitation of the hire business would slow down development.

After discussing the statement the Authority adopted recommendations that the Commissioners should be informed that, in the opinion of the Authority, the year ending December 31st, 1942, should be accepted as the year by which the trading results of the Authority's existing undertakings should not show a loss for the year; and that in the absence of any specific directions by the Commissioners the Authority did not consider that it would be justified, at the present time, in increasing the charges.

The E.A.W. Conference

A review of last week's meetings and social functions

About four hundred delegates attended this year's conference in London, although there is to be another at Glasgow next month in connection with the Empire Exhibition

SINCE the Electrical Association for Women is holding a special conference this year in connection with the Empire Exhibition, Glasgow, it would not have been surprising if the annual conference held in London last week had fallen a little flat. As it was there was certainly no apparent diminution either in the number of members attending or in the energy and enthusiasm which have come to be the mark of every E.A.W. function.

About four hundred delegates from the eighty or so branches came from all over Great Britain to take part in the conference, and a pleasant send-off to proceedings was given on Wednesday evening by a reception held by the National Executive Committee at the Royal Institution. After being welcomed by Margaret Lady Moir, past president, those present were treated to one of those entertaining yet informative lectures which Professor W. L. Bragg knows so well how to give.

Taking as his subject "Knowing all about electricity," he declared that "women would get more 'kick' out of using electrical appliances if they knew how they worked." After demonstrating the basic principles of electricity and magnetism by means of some simple experiments, Professor Bragg asked whether after all we were any nearer than centuries ago to solving the problem of what these forces really were. In the past it was inevitable that men should have tried to attribute these phenomena to some material cause. The further scientists delved into the problem the more they were brought to the conclusion that electricity and magnetism must be taken more or less for granted and that all material objects could be said to be some form of electricity and magnetism. Electricity had made more difference in everyday life than anything else in recent years and the grid was making it possible to replan the country.

The real business of the conference commenced on Thursday when the annual general meeting was held at the Park Lane Hotel, Piccadilly, with the Dowager Lady Swaythling taking the chair in the absence of the president, the Dowager Marchioness of Reading, who is in America. The first subject discussed was the special conference to be held at Glasgow from June 18th to 21st. Mrs. A. E. McColl, chairman of the Glasgow and District Branch, pointed out that the Glasgow Exhibition would be much more beautiful, colourful and artistic than that at Wembley on account of the configuration of the ground, and she urged members to take this opportunity to see some of the many beauty spots that the district had to offer.

Details of the actual programme were given by Miss Caroline Haslett, the director. On Saturday, June 18th, there would be a reception by the president and Council of the Institution of Engineers and Shipbuilders in Scotland at Elmbank Crescent. The Sunday would be left free for visits and the conference would be opened on the following morning at the Dance Hall in the Exhibition by the Dowager Lady Swaythling. Bailie Mrs. Jean Roberts would take the chair at this opening session when various aspects of "Women in Public Life" would be discussed.

An informal luncheon would be followed by a visit to the exhibition, a reception by the Lord Provost and the Glasgow Corporation at the City Chambers being arranged for the evening. At Tuesday morning's session "Business and Professional Women" would be the topic for discussion. There would be another opportunity to visit the exhibition in the afternoon, while those who stayed till the Wednesday might like to take advantage of a trip arranged to Edinburgh. Miss Haslett stated that the number was limited to about four hundred, and already two hundred applications had been received.

Next year's conference is to be held at Cardiff from May 3rd to 5th, and Mrs. A. Lindsay, secretary of the local branch, gave some details of the programme.

Drawing attention to the principal features of the annual report, Miss Haslett said that the Association had had another excellent year. Very keen interest had been shown in the question of kitchen planning, the study of which had been encouraged by the competition for a prize offered by Lady Moir. Interest in housing generally had been maintained. In Birmingham the local branch had co-operated with the Electricity Department in the equipment of an all-electric demonstration house, while the Rawtenstall branch had been responsible for the installation of an electric flat in Alder Grange Council School. In London the E.A.W. was co-operating with the Over-Thirty Association in preparations for building flats for poorly-paid professional women. A joint report by the E.A.W. and the I.M.E.A. on the design of domestic electrical apparatus was issued last autumn.

Progress in the Home Workers' Campaign had been rapid and widespread, and already 197 certificates had been issued as a result of activities in twenty-five centres. In forty other centres classes were being planned or were already in progress. To help would-be students who were unable to pay

[*Elec. Rev. photos.*

Over six hundred persons, representing all branches of the electrical industry, attended the luncheon held on Thursday last week in connection with the annual conference of the E.A.W. Above are seen some of those present together with the speakers, Lady Astor and the Dowager Lady Swaythling (top), Dr. Leslie Burgin, Minister of Transport (left), and Sir Cyril Hurcomb, chairman Electricity Commission

even the small fee required, a bursary fund inaugurated by Sir John and Lady Snell had been created.

The E.A.W. certificates for teachers and demonstrators were becoming recognised as the criterion of knowledge and ability in electrical housecraft, and more authorities were adopting the E.A.W. scale of salaries for demonstrators. A cup in connection with the demonstrator diploma scheme had been presented by Dr. Elizabeth Sloan Chesser. There were now thirty-six schools affiliated to the Association. A very successful summer school attended by nearly a hundred teachers had been held in Glasgow, while conferences in various parts of the country included one attended by seven hundred members at Blackpool. The production of educational films was being held up through lack of funds.

Nine new branches formed during the year had brought the total up to eighty-three, besides three units. The activities of the branches revealed remarkable interest, activity and enthusiasm. Gifts from manufacturers for competitions, whist drives, &c., were no longer to be accepted.

During the year the question had been raised whether the

[Elec. Rev. photo.

Professor W. L. Bragg lecturing at the Royal Institution

E.A.W. should be more definitely associated with the electrical industry, and it had been decided to continue as an entirely separate organisation. Concluding her remarks, Miss Haslett paid a warm tribute to the loyal and wholehearted support of her colleagues and staff.

Presenting the accounts Lady Moir, hon. treasurer, mentioned that the small deficit was due to the fact that the increased activities of the Association had not been accompanied by a corresponding increase in receipts.

Lady Moir, Lady Swaythling, Mrs. G. Z. de Ferranti, Miss F. E. Jones and Mrs. I. E. Bray, were re-elected to the National Executive Committee, and Mrs. J. Entwistle (Birmingham) and Mrs. Watson-Ingram (Buxton) are to fill the vacancies occasioned by the retirement of Mrs. Forrest and Mrs. Newman. The following area representatives were co-opted to the Committee:—Mrs. V. Z. de Ferranti (Manchester), North West England and North Wales Area; Miss N. Balls (Newcastle), North-East Area; Mrs. Yeaman (Stoke-on-Trent), Central England Federation; Mrs. Stanley (Croydon), South-East England; and Miss E. C. Morris (Cheltenham), Western Counties and South Wales Federation. At a meeting of the Council which followed the general meeting the following officers were appointed: President, Lady Swaythling; chairman, Councillor Mrs. Gregory; vice-chairman, Mrs. A. Bentham; and treasurer, Mrs. G. F. Scott.

An amendment of the constitution to reduce the contribution of branches to headquarters from 20 to 10 per cent. of the membership subscription, was adopted unanimously.

Nutrition and physical fitness are to be the subject of special attention by the Association during the current year, and Councillor Mrs. Gregory put forward on behalf of the National Executive Committee the proposal "that greater facilities should be provided for acquiring a knowledge of cooking, economic buying and household management; that fuller publicity should be given to the facts regarding the nutritive value of foods ordinarily in use; and that electrical housecraft classes should be established at all domestic science centres."

While praising the good work done in schools in connection with better nutrition, Mrs. Gregory declared that this was of little use if it was not followed up in the home and housewives must be made to realise their responsibilities. At West Ham, at the request of the women themselves, it had been decided to set up classes in nutrition and dietetics for mothers of schoolchildren. Dietetics were largely a matter of thoughtful common sense and in this the E.A.W. could help a lot.

Seconding the resolution, Mrs. B. Swire said that England as a nation did not know much about nutrition and it was only by learning about it that housewives could buy their food wisely, and many ills of the body came from improper feeding.

The director explained that it was proposed to send copies of the resolution to the Minister of Health and the Board of Education, as well as to local directors of education. The Countess of Westmorland had presented an antique tray for a competition projected in connection with the proposals.

The Luncheon

Over six hundred people were present at the luncheon which followed, Lady Swaythling again presiding.

The debt owed by the electrical industry to the E.A.W. was stressed by Dr. Leslie Burgin, Minister of Transport, in proposing the toast of "Electrical Progress." The trend of progress, he said, made it essential to encourage the development of new industries. Electricity was one which had grown up during their own generation. In fact, during the past ten years the number of consumers had increased by more than three times from 2,668,000 to 8,557,000, while sales of electricity had risen from 7,003 million to 17,147 million kWh.

The E.A.W. held a key position in the future progress of the industry. The promotion of the wider use of electricity in the service of women, the collection and distribution of reliable information on modern electrical appliances and the demonstration of the benefits of electricity all owed much to the activities of the Association. The striking expansion in domestic supplies over the last ten years coincided closely with the widespread development of the organisation and a special tribute of thanks was due to Miss Haslett.

In response, Lady Astor, first president of the E.A.W., congratulated the Association on its policy of educating rather than advertising, and for not being commercially minded.

Replying to the toast of "Our Guests" proposed by Lady Swaythling, Sir Cyril Hurcomb, chairman of the Electricity Commission, said that where the Association was so valuable was in backing up the work of the electricity supply undertakings and the manufacturers.

On Thursday evening a reception by the committee of the London Branch was held at Overseas House, Mrs. T. Campbell, chairman of the branch, welcomed the delegates.

Councillor Mrs. Gregory presided at a branch session held on Friday. Indicating possible lines of approach for future development of the use of electricity in the home, Miss Haslett emphasised the fact that cheap electricity was now available over a very large part of the country and suggested that there was an urgent need for the appointment of more demonstrators and also public relations officers to bring to the notice of the public the products of the electrical industry now available. Branches should discuss with the local supply engineers any possible means of improving facilities.

"Is the E.A.W. electrically minded?" was the subject of a discussion opened by Mrs. T. Campbell, chairman of the London Branch. Miss R. Brown (Liverpool) urged that branches should see that members of committees used electricity extensively in their own homes, and Mrs. Margary mentioned that fifty members at Wolverhampton were attending a home-workers' course specially arranged for them.

Safe Wiring

Proposing the motion "that the E.A.W. should consider if it would be possible to ensure good safe wiring in a house," Councillor Mrs. Hyde (Birmingham) said that while she agreed that shocks and accidents were usually due to faulty wiring and bad workmanship it was true that familiarity sometimes bred contempt. Unfortunately, there was no legislation which compelled contractors to work to the I.E.E. Regulations and the last word rested with the supply undertakings. Women should insist that all materials used in their installations were British, all cables of well-known brands and all plugs three-pin. Mrs. Yeaman (Stoke-on-Trent) said that the time must come when all electrical contractors and their employés must be registered by law, while Mrs. Waite (Hull) stated that shoddy work was often due to the fact that the customer would not pay the price asked for good work. Other suggestions included the inauguration of an inspection service (Miss Greenwood, Cleethorpes), the holding by branches of at least two practical demonstrations a year (Miss McLean, Harrogate), the preparation of a list of faults to look for (Mrs. Griffiths, Birmingham), and the provision of more assisted or free-wiring schemes (Mrs. Swire).

Speaking on the usefulness of women on electricity committees Bailie Mrs. Roberts (Glasgow) said that the electrical facilities provided in the domestic field were largely a matter for women, who should demand a fair share in their control.

A ball at the Park Lane Hotel concluded the conference.

A Welsh Cable Factory

Giving employment in a distressed area

IN their decision to erect a factory in South Wales in a district that was not catered for by any of the trading estates, the directors of the recently formed Aberdare Cables, Ltd., were influenced by the Government's appeal for the establishment of new industries in districts which were hard hit by unemployment.

Aberdare is situated at the centre of the four industrial valleys of Merthyr, Neath, Rhondda and Aberdare, and lies in pleasant surroundings. The factory building, of steel, concrete and glass measuring 450 by 130 ft., stands on a 30-acre site and can be readily extended. Concrete roads surround the site and a railway siding runs up to the works.

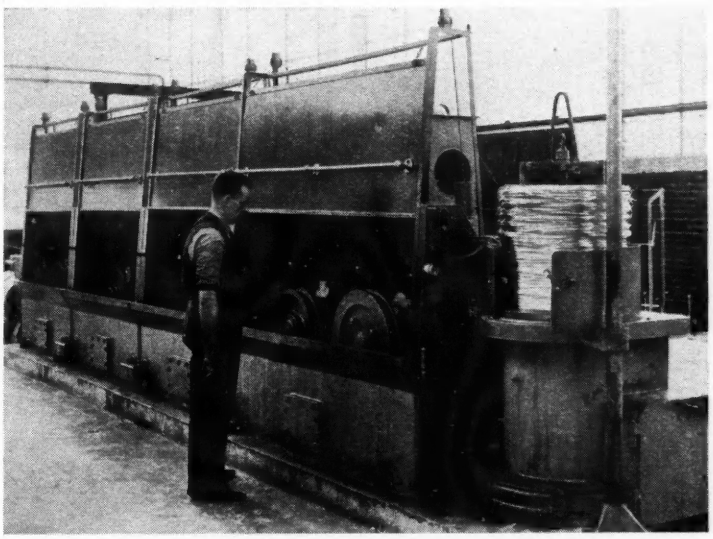
Production is confined to paper-insulated cables up to 11 kV. The factory is entirely self-contained and laid out for continuous flow production through the shops. All materials before entering or leaving the works are weighed on a 60-ton weighbridge and the main shops are served by 10-ton cranes.

Wire is drawn from ½-in. electrolytic-copper rod and is tested for chemical qualities, tensile strength, elongation, conductivity and gauge. Ends of rods needed to form a continuous conductor are electrically welded by Holden & Hunt machines. The copper is then dry annealed in a thermostatically controlled 75-kW Birlec electric furnace, in conjunction with a plant for producing the inert gas atmosphere required for a bright, smooth finish. The cycle takes about four hours with an initial temperature of 380 deg. C. and six tons can be annealed per shift. Stranding machines capable of dealing with any number of wires from 7 to 127 with pre-twisting devices come next in sequence. For paper insulating the variable-speed machines have tangential heads, which ensure tight lapping and registration, and vertical high-speed lapping devices are available for smaller cables. Wood-pulp or manilla paper is used as the customer desires. A micrometer adjustment is fitted to each flyer of the laying-up machines for ensuring the correct setting up of pre-twisted cores before and during the process.

Oil for the impregnating plant is received in 12-ton heated tankers direct from the oil refinery and immediately on arrival is dehydrated and filtered. Jacketed impregnating pans are heated from the high-pressure hot water system, and a vacuum residual pressure of 1 mm. is obtained by the use of oil-sealed valves. Oxidation of the compound is prevented by keeping it in a closed system free from contact with the air. Impregnation is carried out at 80 lb. per sq. in. for low- as well as high-voltage cables.

Lead presses are installed for covering cables up to 4 in. in diameter. These have electrically heated die blocks, thermostatically controlled. The lead is first put into a melting pot in which the dross (or oxide) constantly rises to the surface. Pure lead from the bottom passes at 770 deg. to a sealed lower pot so that the press container is fed only with uncontaminated lead, the temperature of which is about 380 deg.

Steel-tape and wire armouring machines completing the process are arranged for the application of both jute and hessian servings. Almost all parts of any machine are interchangeable so that a quick change over can be made to suit the work in hand. Cables are tested for electrical and mechanical strength after lead covering and again after armouring before despatch. The company manufactures its own cable drums of standard dimensions. Illumination is provided by mercury-vapour lamps in Revo fittings. The motors for the main drives were manufactured by Laurence, Scott & Electromotors, Ltd.



An 11-die wire-drawing machine

For heating purposes throughout the works water is used at a pressure of up to 120 lb. per sq. in., the corresponding temperature of which is approximately 350 deg. F. with a minimum return temperature of 300 deg. F. This is provided by a La Mont forced-circulation boiler, with 1,785 sq. ft. of heating service and a capacity of 9 million B.th.u. per hr., in conjunction with an "H.K." superheated water system (Hobdell Engineering Co.). The circulating pump is provided on the return side of the boiler instead of on the flow so that the maximum pressure is that of the boiler and isolating valves automatically close in the event of abnormal flow. Firing is by a Riley "Robot" stoker using coal with a calorific value of 14,520 B.th.u. per lb.

Electricity is obtained from the South Wales Power Co. at 11 kV and transformed to 400 V in a sub-station on the site.

Aberdare Cables, Ltd., has been formed with an initial capital of £250,000 under the chairmanship of Mr. G. C. Usher (managing director of International Combustion, Ltd.), and among the shareholders are some electricity supply undertakings.

The main contractors were: Gee, Walker & Slater, Ltd. (buildings); B. French, Ltd. (electrical installation); International Combustion, Ltd., and Ivor Power Speciality Co.,

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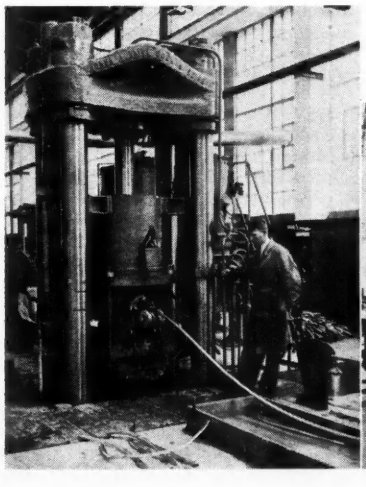
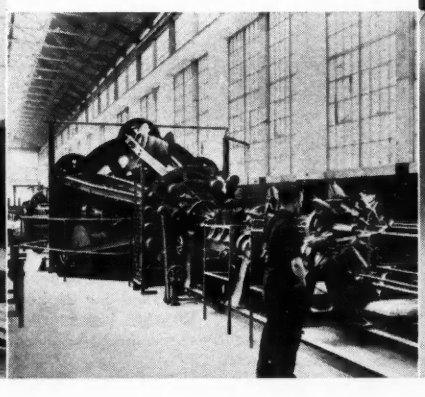




Left: Lead-covering press. Centre: View of core laying-up machine and paper-lapping machine. Right: Steel tape armouring machine showing lapping head

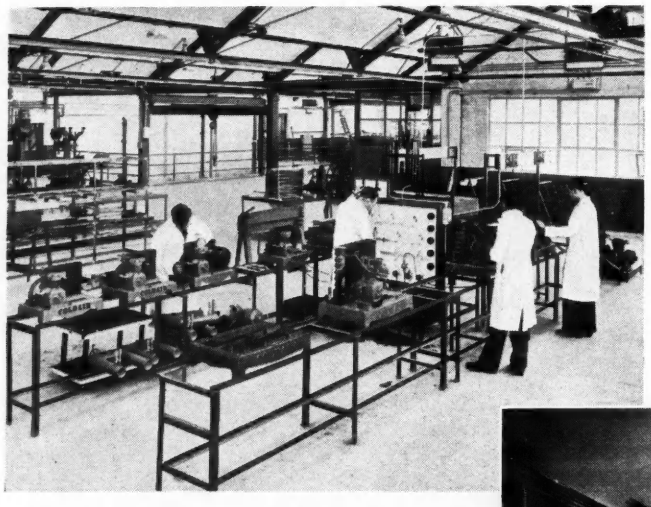
Modern Refrigerator Manufacture

A new factory at Wembley

Very accurate production and thorough testing for a long period are the principal characteristics of the methods adopted in this latest addition to the G.E.C.'s productive organisation

THE high standard of cleanliness maintained throughout the factory and the large number of individual tests were points which impressed us most during our visit to the new "Coldair" refrigerator factory which the General Electric Co., Ltd., has recently erected at North Wembley.

The factory is a two-storey building the ground floor of



which is devoted to an unloading dock for raw materials, an inspection bay through which all new material passes, a test bay for the final proving of refrigerators and a loading bay for the finished

Above: The condensing unit assembly benches for commercial models. Right: The machine shop for the compressor and condenser parts

products. Motors and thermostats are fully tested before storage.

To obtain the utmost elasticity coupled with a smooth production flow special steps have had to be taken to ensure that every individual part is made, tested and stored in a special store which is situated next to the department which requires that part for the next step in assembly. Thus there is always a reserve store of parts in each section should the speed of assembly exceed production for any reason, or *vice versa*. In the same way assembly can be switched from one type to another without affecting the machine shop immediately. Inspection tests are carried out before storing in each section so that any faults can be found before assembly, no fewer than twenty tests being carried out during production.

Some idea of the precision with which the parts are produced can be gauged from the fact that the cylinder bores are ground to a limit of 0.003in. and in the machining of pistons, shafts, valve plates and internal compressor components limits of the order of ten thousandths are standard. Every finished model is subject to a lengthy continuous operation, fully recorded, before being sent out for final inspection and packing and special sound insulated rooms are provided for the silence tests.

The compressor is of the low speed single acting piston type made of "Meehanite," a hard close-grained type of cast iron. The selection of compressor parts from the stores is done by the tester to ensure that only well matched parts shall be used. The completed compressor is run for four hours, and afterwards the pumping capacity, tightness of valves and silence are measured. The control of the condensing unit liquid is carried out by means of the latest form of "high-side" float. The compressor, condenser and float are mounted on a bed plate and the whole assembly baked for eight hours in a vacuum to remove every trace of moisture. This is important as 0.002 per cent. of moisture would freeze in use and cause trouble. Next the oil wells are filled with lubricant and the compressor is charged with refrigerant; sulphur dioxide is used for domestic models and methyl chloride for the commercial refrigerators. The units are fan cooled.

In order to ensure silent operation in domestic refrigerators the condensing unit is mounted on a system of two steel tubes and eight rubber blocks and the machine compartment at the bottom is lined with sound-absorbing material. The evaporator is built up entirely from copper tubes and plates, welded together and tinned. The front panels are chromium-plated.

The condensing unit coupled to an evaporator can now be tested as a refrigerating unit. A running test is carried out under standard conditions in a sound-insulated room, and the B.th.u. extraction is measured; careful watch is also kept for undue noise and vibration. The steel shell, which is manufactured in the factory, is built up of steel plates, which are cut to shape, blanked, formed and welded. It is prepared for enamelling by immersion in three tanks in succession; in the first it is degreased, and in the second bonderised, while in the third a bichromate solution reinforces the anti-rusting effect of bonderising. Finally the shell is baked to remove moisture. A high quality finish is obtained by the use of sprayed synthetic enamel and ovens equipped with automatic temperature control. Two coats of white enamel are applied to the metal parts of the shell. The first coat is burnt on by baking for 1 hour at a temperature of 350 deg. F., and the second coat is baked for 1½ hours at 285 deg. F. The shells are carried through the ovens at the correct rate by an automatic conveyor, and the oven temperature is thermostatically controlled.

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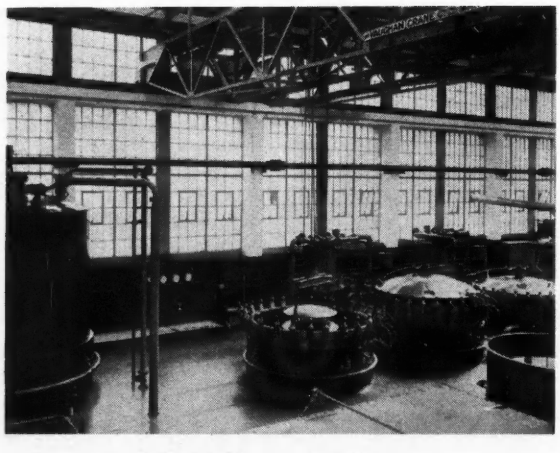
A Welsh Cable Factory (*Concluded from page 647*)

Ltd. (boiler house); and General Engineering Co., Ltd. (impregnating plant and heating system).



A view of the impregnating pans

Meetings and Discussions

The annual meeting of the Iron and Steel Institute has been held this week, and the twenty-four papers presented contained many references to electrical practice, particularly in connection with furnace operation. The various methods of removing suspended matter from industrial gases were described at a meeting of the Institute of Fuel by Mr. R. R. Harmon last week. Dr. Ellingham's paper, read before a joint meeting of electrical and chemical engineers at the I.E.E. last Thursday, evoked contributions from a number of speakers upon the design and operation of large electrolytic plant.

Steelmaking Furnaces

A SYMPOSIUM on steelmaking, with special reference to the acid and basic open-hearth processes, was arranged in conjunction with the annual meeting of the IRON AND STEEL INSTITUTE in London from May 4th to 6th.

The first two days' discussions related to twenty-four authoritative papers which set out the differences in British practice and the reasons for them. Some 344 open-hearth furnaces produced 12 million tons of steel in 1937.

Typical electrical equipment employed includes 125-, 100- and 75-ton overhead travelling cranes for handling materials, together with 15- and 10-ton overhead travelling magnet cranes for dealing with scrap metal, the lighter classes of which may in some cases be bundled in a press which is fed by a 5-ton overhead magnet crane. Furnace-charging gear is assisted by 10-ton jib cranes with electro-magnets.

The Barrow Haematite Steel Co., Ltd., employs mobile steam driven magnet cranes, each generating its own electricity, for handling scrap, while some of this company's casting ladles (70 tons) are carried on electrically driven carriages instead of being lifted by cranes. Pit work is generally done with the aid of electric overhead cranes of 35 tons with auxiliary 10-ton hoists, in addition to 5-ton jib cranes.

Large Tilting Gear

At the East Moors, Cardiff, plant of the Guest Keen Baldwins Iron & Steel Co., Ltd., the 600-ton hot metal mixer is mounted on roller paths and is tilted by rack and pinion gear, which is operated by a 180 b.h.p. motor, with a "dead man" pedal controller that automatically restores the mixer to the vertical position in emergency. The 200-ton furnaces are tilted electrically in the same way.

At the Irlam works of the Lancashire Steel Corporation, Ltd., electro-hydraulically operated "Arca" regulators are employed to adjust the pressure in the fuel gas mains between the producers and the furnaces. Thermocouples and pyrometers are normally used for recording temperatures. The Park Gate Iron and Steel Co., Ltd., Rotherham, has effected furnace reversal at specified intervals of time, but it is now fitting all its furnaces with signalling gear operated on the temperature-difference principle. The whole shop is so wired that a continuous record of temperatures in the gas and air systems of any furnace can be obtained on multi-point recorders, centrally situated. Each of this company's open-hearth furnaces is fitted with a waste heat boiler for producing steam, each exhaust fan being driven by a 35 h.p. motor.

The melting shop of Steel, Peech & Tozer at Templeborough (Sheffield) has a frontage of ¼ mile. The output ranges up to 12,000 tons of ingots per week, the whole of which is cogged down in a powerful electrically driven mill, and 75 per cent. of the product of this reversing mill is rolled into billets in a continuous mill.

Among the series of research papers being considered on the third day of the meeting is one in which Prof. C. R. Austin and Mr. H. D. Nichol (Pennsylvania State College) describe results obtained with, and constructional details of, new apparatus they have devised for evaluating the high-temperature deformation characteristics of alloy steels. They use an electric furnace with means for independently loading six test samples, together with a contact indicating micrometer, which is wired into a grid glow-tube circuit, by means of which length changes of 0.0001 in. can be observed. Temperature is controlled by a micro-switch operated by a silica rod inside a closed stainless-steel tube that is placed close to the main furnace winding as well as being made part of the electrical circuit of the main winding.

For determining the coefficients of thermal expansion of chromium steels Messrs. J. A. Jones and W. C. Heselwood (United Steel Companies, Ltd.) have constructed a dilatometer with special care to ensure uniform temperature, indicated by a thermocouple. The furnace winding is on a refractory tube, and the differential expansion between metal and similar fused silica specimens is arranged to rotate (by means of extension rods) a mirror that is observed by a telescope and illuminated scale. The magnification of 414 enables length changes of 0.00001 in. to be measured. The steels tested were made in a 35-kVA high-frequency furnace of the Ajax-Northrup spark-gap type.

Melts were made in a high-frequency Ajax-Northrup induction furnace of 15 kW under carefully standardised conditions by Principal C. A. Edwards and Messrs. D. L. Phillips and D. F. G. Thomas (Swansea) for studying how composition and treatment influence the rate of acid attack on mild steel (on behalf of the South Wales Siemens Steel and Welsh Sheet and Plate Manufacturers' Associations).

A horizontal furnace, "Concordin" wound in five sections, individually controlled, has been employed for an experimental inquiry into the influences of hydrogen and steam in blast-furnaces by Drs. W. A. Bone, H. L. Saunders and H. J. Tress (Bone Research Association, Ltd., London).

For studying peculiar microstructures formed in rapidly cooled ingot iron and mild steel Mr. B. Jones (University College, Cardiff) and Mr. N. Gray (Port Talbot) heated bars in a wire-wound vertical furnace having a drop bottom to facilitate instantaneous quenching. Temperature was measured by thermocouple and adjusted by a Cambridge automatic potentiometric controller.

Cleaning Industrial Gases

THE removal of suspended matter from industrial gases is dealt with in a paper which Mr. R. R. Harmon read before the INSTITUTE OF FUEL in London on April 28th. Such processes as settling, centrifugal cyclone, impingement, filtration, wet scrubbing and electrostatic precipitation are briefly mentioned before the author passes on to the consideration of the nature of gases, effect of mass and sizes of contaminating particles, their "wetability" and surface tension.

Modern Refrigerator Manufacture (*Concluded from preceding page*)

The insulation for the cabinet consist of "Tropal," a British-made quilted kapok; it is 2 ins. thick and is packed in bituminised paper bags, which are sealed with bitumen in order to exclude air. Its heat conductivity is extremely low (considerably lower than that of cork), it is light in weight and is vermin-proof, and it does not absorb moisture.

The cabinet having been completed, the condensing unit and the evaporator are put into position and bolted down. The complete refrigerator is then ready for the duration tests, which are carried out on the ground floor of the factory and last seven days. The factors investigated include the number of refrigerating cycles per day under given conditions, the rate of heat loss from the cabinet, the accuracy of the thermostatic control, economy in performance, and silence in operation. Each of these—and many other—requirements must be satisfied fully for seven days in succession. The refrigerator then undergoes final inspection in a warm room, where the ambient temperature is maintained at 70-80 deg. F., special attention being given to the absence of noise and vibration.

All the tests are carried out on the entire output of the factory. In addition, however, a random selection of the factory output is taken at frequent intervals and tested in the laboratories under tropical conditions, temperatures up to 110 deg. F. and humidities up to 80 per cent. being obtainable.

Apart from a variety of commercial units the range of refrigerators contains eleven domestic models in sizes from 3 cu. ft. to 20 cu. ft. Of special interest is the "DMA50," a 5 cu. ft. model with a table top 3 ft. high, the compressor being at the side of the cabinet under a large drawer. The "DMA52" is similarly constructed, except for the absence of the drawer above the compressor, and the stainless steel top is designed to form a sink and draining board.

At the luncheon on the occasion of our visit to these works last week, Mr. M. J. Railing, vice-chairman and managing director of the company, said that the building of the new refrigerator factory represented part of the G.E.C.'s slogan "Everything Electrical." He also gave a résumé of the history of the G.E.C. from the days when the concern only had about 50 employés. Now its vast organisation extended over all parts of the world.

Regarding the condensation of water vapour as a means of purification, by the formation of droplets containing dust particles, the author complains that common practice seems to consist in the bountiful provision of sprays and baffles without adequate regard for the conditions that hinder or facilitate the loading of the particles sufficiently to enable them to precipitate against the upflowing gas currents.

The system devised by the Peabody Engineering Corporation (embodying the author's patents) is a step-by-step process which is claimed to obviate uneconomical features and render the scrubbing efficiency practically independent of liquid through-put.

Intensive scrubbing by the action of heavy hot water sprays removes all solids yielding to mechanical treatment while the gases are at a temperature above their maximum theoretical dew point. Simultaneously there is a transformation of sensible into latent heat, accomplished by recirculation of hot water through the primary stages, so permitting time for humidification and thereby preventing condensation during these two operations.

The humidity is regulated to maintain dew point uniformity and the degree of cooling is adjusted step by step so as to cause the water vapour to condense on the finer residuals. The gas thus becomes progressively cleaner and cleaner, the number of stages needed being governed by particular requirements.

Applications of Electrolysis

THERE was a relatively small attendance at the meeting of the INSTITUTION OF CHEMICAL ENGINEERS at, and jointly with, the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 27th to discuss Dr. H. J. T. Ellingham's paper (to which reference was made last week) on the principles on which electrolytic plant is designed and operated.

Mr. H. Orchard spoke of the relative merits of different types of converting plant for providing d.c. He said that his firm made all four types and at the voltages used for these processes in this country (not more than 300 V) there was little to choose between the rotary convertor, motor convertor and motor generator from the point of view of efficiency, while the more efficient rectifier did not come into the picture for voltages below 450 V.

Mr. A. P. Newall gave a brief general description of plant being operated in this country for the production on a semi-commercial scale of lead and sulphur, simultaneously, by electrolytic means. The process, which was a new one, was as yet imperfectly understood. The electrodes did not deteriorate, because sulphur was liberated instead of oxygen. Galena ore was the raw material employed, dissolved in fused lead chloride. A concentration of 20 per cent. might be used, but for practical reasons 2 to 5 per cent. was preferred. It was necessary to employ large cells, capable of producing 4 to 5 tons of lead per 24 hours, so that with the ordinary parallel arrangement 100,000 A would be needed with 1.5-V drop. But by using bi-polar series electrodes spaced 0.5 in. apart a higher voltage could be used for the same input of 150 kW, which would reduce the current to 10,000 A with 15-V drop. The current was maintained constant, but the voltage could be varied somewhat for regulating the temperature of the electrolyte and also served as a useful guide in feeding the cells. Circulation of the electrolyte was of importance, since the cell was divided; therefore positive agitation was provided.

Copper-oxide Rectifiers

Dr. H. Kronsbein discussed the theory of electrode reactions (classified by the author as ionic and electronic), and suggested that below certain voltages both reactions were likely to occur at the same time. He referred to the suitability of copper-oxide rectifiers for providing d.c. for electro-chemical purposes, especially electroplating, remarking upon their long life, small maintenance requirements and superior efficiency as compared with the convertors which were at present obtainable in this country, the efficiency of which was said not to exceed 50 per cent.

Capt. A. I. Wynne-Williams said that electrode reactions could only be considered to be "simple" in theory; in practice they were always complicated by impurities and "side" reactions. Nearly all reactions took place within a small "contact" film of electrolyte near the electrode, and the chemical constitution of that film was very different from the constitution of the rest of the electrolyte. The speaker then described plant he had designed, which was installed in a factory in this country, for producing thin copper sheets by formation on rotating drums. More than 4,000 A was passing into each drum through plain roller bearings, which had proved to be the most satisfactory method after many kinds of brush and other types of collector gear had been tried. The electrolyte was continuously circulated by pumping through filters from central storage tanks. Its temperature was normally maintained by the IR loss in the cells, though immersion heaters were provided in the storage tanks for use when starting from cold.

Mr. A. E. Knowles briefly referred to the electrolysis of water for the production of hydrogen and oxygen gases. The temperature should not exceed 70 deg. C., and the cells needed about 10,000 A. About 600 V was required and the back e.m.f. was 1.47 V, decomposition commencing immediately that e.m.f. was exceeded. As this process could be started and stopped at will without ill-effects, it was peculiarly adaptable to the utilisation of off-peak electrical energy.

Prof. C. L. Fortescue suggested that smoother voltage regulation should be obtainable by means of simple induction regulators rather than by tap-changing transformers, but Mr. D. Ashby declared that the cost of induction regulators was prohibitive. A cheaper method of obtaining fine control was tap changing so devised as to avoid breaking the circuit. Chromium plating was one of the few processes which seemed to be adversely affected by breaking the circuit.

Dr. W. Cullen, who presided, emphasised the usefulness of joint meetings to consider marginal subjects. More electricity was being consumed in this country for electro-chemical process than was generally imagined. The production of carbide was receiving attention, as was also the manufacture of ferro-alloys. At present the latter were made of British materials that were sent abroad to be processed with the aid of foreign power and were then returned to Great Britain as finished products.

The author, in reply, said that there was nothing mysterious about the use of bi-polar electrodes in series. The explanation was that the current preferred to pass across the small inter-electrode spaces, rather than take the longer path round them through an electrolyte whose conductivity was about one-millionth of that of the short path. The making of carbide and ferro-alloys involved electro-thermal processes and therefore did not come within the province of a paper on electrolysis. One of the reasons why this country had lagged behind others in the utilisation of electrolytic processes was the mistaken idea that the cost of electric power was the determining factor. A large copper refinery recently established in Rhodesia, however, derived its electric power from a steam generating station specially built for the purpose. In that case site and labour costs had been the predominating factors.

Sir George Lee, president I.E.E., supported Dr. Cullen's remarks on the desirability of joint meetings and hoped that the paper would stimulate interest in this subject, which had not been dealt with at the I.E.E. for a long time though considerable development had taken place since the matter was last raised.

Fires in Mines.—An analysis of fires in mines from 1919 to 1937, inclusive, showed that out of 73 instances caused by electrical defects 54 were due to defects in, or damage to, cables. This was among the observations of Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, addressing a meeting of the South Staffordshire and Warwickshire branches of the INSTITUTION OF MINING ENGINEERS, at which local members of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS were present, at Birmingham recently. When it was possible to form an opinion as to the cause of such fires, he said, there was evidence of mechanical injury, a faulty joint, or a loose terminal connection. Mr. Horsley discussed the use of automatic safeguards against over current by means of fuses and automatic circuit breakers, thermal or electromagnetic, and against leakage to earth. He suggested that in controlling fire risk the following precautions should be observed: live cables should be switched off when not in use; mechanical injury to cables should not be ignored, even though not resulting in a breakdown; suspected defects should receive immediate attention; automatic protection appropriate to the circuits should be provided; automatic devices should receive skilled and regular examination; and particular attention should be given to the mechanical attachment of cable ends and to the protection and sealing of the insulating material at terminals.

Molecules and Refrigeration.—In the course of the 1938 James Forrest Memorial Lecture to the INSTITUTION OF CIVIL ENGINEERS in London on May 3rd, Sir Frank Smith dealt with the disorderly movements of molecules and their application to refrigeration. He pointed out that just as nature in the inorganic world arranged the atoms of crystals to form substances having diverse properties, and in the organic world built up groups of atoms to fulfil definite functions in plant and animal life, so the disorderly movements of atoms and molecules appeared to be designed primarily to facilitate changes of composition and structure and to be the main agent in the transmission of heat and power. Those disorderly movements represented definite amounts of mechanical energy, and it was on the hypothesis that that energy was identical with heat that thermo-dynamics and mechanics became united. The quantity of heat in a substance was therefore a measure of the total kinetic energy of the molecules, and temperature was a measure of the intensity of their translatory movement, being zero on the absolute scale with zero movement.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Organisation of Non-statutory Suppliers

Which companies or individuals supplying electricity without statutory powers, and their consumers, would care to co-operate with a view to securing fair treatment, especially having regard to possible new legislation? Any such are invited to communicate with me stating their willingness to investigate the situation in order to decide the best course to pursue, without further obligations on their part unless these are voluntarily assumed later.

In the ELECTRICAL REVIEW of January 2nd, 1931, I set out the position in relation to the village of Hurstmonceaux in Sussex, where a local resident was furnishing an unauthorised supply to 100 cottages (including 25 cooker users). Since that date the responsibilities have been taken over by a statutory undertaking which compensated the former owner.

On the other hand, the distribution system in the parish of Herne, provided by the principal landowner, was not purchased when the Herne Bay & District Electricity Supply Co. acquired in 1926 statutory rights to supply in the area of which the village is a part, although the parish was scheduled in the draft Order. The appropriate local authority, Blean R.D.C. opposed the granting of the Order unless protection were afforded in respect of the supplies given in Herne parish, but the Electricity Commissioners decided to dispense with the consent of the Council.

The position is that, after twelve years, more than 150 consumers are still unrecognised either by the Herne Bay Co. or by the Commissioners because they take a supply from the only existing distribution system. They are not guaranteed a continuous supply, a voltage constant within ± 6 per cent. of the declared pressure, or the same charges for similar uses. It would be unreasonable, in my opinion, to expect the present distributor in Herne Parish to spend further money in improving the supply without the protection for which Blean R.D.C. asked.

This example may be typical of conditions obtaining in many of the 800 or more non-statutory supply concerns (past and present). Co-operative action, in which their consumers might take part (since they owe the amenities derived from electricity to the initiative and foresight of these pioneers) would, I believe, bring about a recognition of their right to reasonable treatment. My services as honorary secretary are offered for the time being, to co-ordinate and communicate all suggestions offered. THEODORE STEVENS.

11, Dence Park, Herne Bay, *May 2nd.*

Low Voltage Loses Client

At a registered R.A.C. and A.A. hotel just outside the area supplied by this company, a motorist complete with luggage drew up yesterday. He went into the hotel and asked for a room with which he seemed very pleased, but before deciding definitely whether he would stay he asked whether the hotel was supplied with electricity. "Yes, most certainly!" "What voltage?" he asked. "Oh, 50 volts. We have our own plant," was the reply. "Oh," said the motorist, picking up his hat and coat, "I regret I cannot stay here. You see, I have an electric razor and I must be where there is a 230-volt a.c. supply!"

Whether the hotel will now ask for an extension to be made to make our supply available, or will try to obtain 50-volt d.c. razors, is a debateable point. L. J. SUTTON,

Manager, Towyn, Aberdovey & District Elecy. Co., Ltd.

Towyn, Merioneth, *April 29th.*

Working to Music

Exactly six months ago, a wireless set was installed by my company in its Wembley factory. To the surprise of myself and my fellow directors, this experiment has increased production by over 10 per cent., the interesting point, however, being that whilst the innovation has been more than welcome to the actual factory workpeople, the reverse is the feeling of the office staff, the former being girls, the latter men.

Have any of your readers, I wonder, had a like experience?

REGINALD LESLIE,

Chairman, Union Lamp and Lighting Co., Ltd.

Wembley, *April 26th.*

The Design of Electric Cookers

I was very interested in Mrs. Rayner's article in your issue of April 22nd, but there are several important questions on which my point of view—that of a demonstrator and showroom assistant—differs from hers.

Mrs. Rayner suggests dividing the oven into two parts, with separate heaters and switches. This would defeat its own object, because simplicity is the first essential in all cookers, and two switches would at once suggest to the average housewife that the management of the oven was complex. I have always found that one of the greatest advantages of electric cookers, from the demonstration angle, is the simplicity of the control. The separate and larger grill which Mrs. Rayner puts forward would at once increase the initial cost and the current consumption, and these two items must not, however, convenient the improvement, be affected.

Very many undertakings include a kettle in the hire charge, and do not let a cooker go out unless a kettle is sent with it. If this practice were universal, there would be far fewer complaints of slow heating of water, and the necessity, which Mrs. Rayner stresses, of having radiant elements in all cookers, would not be so pressing.

BERYL O. WATSON,
(Student I.E.E.).

Oxted, Surrey, *April 26th.*

High-voltage Technology

Having read in your issue of April 22nd Professor John's article on the facilities provided at Queen Mary College for high-voltage instruction and research work I feel that it is only fair to my predecessor, Emeritus-Professor W. M. Thornton, and my colleagues at King's College, to say that for many years lectures and experimental work on high-voltage phenomena have been included in the curricula for our final and honours students, and that at the present time research work by Ph.D students and investigations for the Electrical Research Association are being carried out in our high-tension laboratory.

It is well known, of course, that the high-voltage laboratories at Queen Mary College are among the most lavishly equipped in the country, but I do not think the impression should be allowed to persist that high-voltage instruction and investigation are or have been disregarded by other colleges.

J. C. PRESCOTT, *Professor of Electrical Engineering.*

King's College, Newcastle-upon-Tyne, *April 29th.*

Salaries Schedules

The article by "Power Engineer" which appeared in your last issue, is of great interest and he might have enlarged upon his theme where he refers to the arrested development of stations and their relegation to the secondary or "booster" class.

I am employed in such a station. In pre-grid days we put our best foot forward and by adopting a policy of gradual betterment, a low cost, and strict attention to detail, helped by a rising load and improving load factor, we succeeded in raising our thermal efficiency from the region of 14 per cent. to over 18 per cent. Then the grid came along and all this was knocked flat. Since then we have been a mere boosting station, up and down many times a day, expected to carry out all sorts of acrobatic evolutions at short notice and given operation programmes which are very nearly adhered to.

This sort of thing is all the more galling when one is aware of several cases where stations which in pre-grid days made little or no attempt to improve themselves and have since been "selected," extended and raised to the "super" class largely on account of their geographical situation. For the most part the original staffs are retained and these men are now in charge of big jobs which are frequently beyond their capacity to handle, but, nevertheless, they are drawing the appropriate salaries. The pill is all the more bitter to swallow when one realises that the load which has justified the creation of super stations has to a large extent been filched from progressive smaller undertakings like ourselves. The staffs at such smaller undertakings have thus been robbed of an opportunity to be re-graded. In our own case we should have installed at least double our present capacity had there been no grid.

I have visited several of these "super" stations and it appears to me that life in such stations is a gentleman's one compared with ours. Sets are only started and stopped about twice a week and boilers little more. The plant is usually of the best that money can buy. Load changes are infrequent and they know almost exactly what amount of coal they will require from one week to another. And they have the comforting knowledge that if a breakdown occurs the boosting stations are there behind them ready to step into the breach.

It is obvious that someone has to have such plums as these, but why cannot things be so arranged that they go to the men who deserve them; men who have kept themselves up to date, alert, and ready for anything. Let the stick-in-the-muds (and there are plenty of them) be relegated to the secondary stations. Or is it a fact that it needs the best men to run the secondary stations?

I have often advocated that the C.E.B. shall take a greater

degree of responsibility in the staffing of stations and in this connection that a personnel department be created. Some of the larger steamship lines organise things on such a basis and men are moved from one ship to another according to their merits and seniority. If such methods were adopted by our own industry I consider that it would work to everybody's advantage except those who had failed to keep themselves abreast of the times. ANOTHER POWER ENGINEER.

April 29th.

The article in last week's issue by "Power Engineer" contains some interesting points, but in referring to the question of bulk supply and its effect on the classification of the station receiving it, there was some confusion between the different conditions when stations' classifications are based on plant capacity or maximum demand.

Taking plant capacity first. In this case a certain percentage of the installed kilowattage can be added to the capacity of the generating plant to obtain the total capacity on which the station is classified, provided the supply is taken from an outside source, and it is felt that the only matter that requires investigation in this respect (forgetting for the moment the expression "outside source") is whether the percentage at present allowed is large enough to safeguard the engineer in respect of the normal increase in the capacity of his station that would have taken place if the C.E.B. had not come into existence. If the allowance is not large enough the engineer should be entitled to compensation in respect of future increases that have not materialised due to the taking of a bulk supply in the same way as engineers are compensated for loss of office or reduction in status through the taking of a bulk supply from the C.E.B.

With regard to the classification of a station on maximum demand there is no provision for the addition of any allowance for any form of bulk supply which comes on to the station bus-bars, which, in my opinion, is grossly unfair. It is difficult to see why a station which is generating, say, 40,000 kW and gradually builds up an imported load of an additional 40,000 kW, with its accompanying increase of responsibility, can take no account of this imported load, and its engineers are paid the same salaries as when the station was merely generating its own power without any anxiety as to the stability of the imported load, quite apart from the attention required in regard to auxiliaries, &c., connected with the supply. It must also be realised that "imports" do fail at times, and it only requires a small partial failure to upset the equilibrium of the generating station.

With regard to the expression "outside source" contained in the present schedule in respect of imported load, while the underlying principle seems to be that an undertaking should not be called upon to pay twice for handling a certain portion of its output, surely if it arranges its methods of handling load so that two stations deal with it and two sets of station engineers are affected thereby, then it should be prepared to pay for such an arrangement.

If the supply comes from an outside source, in certain circumstances the engineers affected can benefit from it, but experience has shown that an engineer who handles an imported load from an outside source is in a far happier position than the engineer who deals with an imported load from another station in his own undertaking, because in the former case the outside supplier can usually be relied upon to do all in his power to maintain the supply, while in the latter case, when a failure or partial failure occurs, the unfortunate engineer, whose imported load is not what was expected at any moment, has to get out of his difficulties for his own sake and for the sake of his colleagues working with him in the undertaking.

I have a shrewd notion that the alternative of classification by plant capacity will be dropped, and very rightly, too, as under present-day conditions very little spare plant is available; in fact, there are stations working with a maximum demand above the plant capacity on the economic ratings of the sets. It is hoped that this will be agreed upon, and at the same time it is stressed that for fair treatment, if the maximum load system is adopted as the one and only method for classification, due allowance should be made for imported load no matter what its source. WESTERN.

May 2nd.

The Case of the Shift Engineer

From personal experience I am in full agreement with all that "Charge Engineer" says in his letter in your issue of April 22nd. In his article last week, "Power Engineer" alluded to the argument that a shift charge engineer requires no special technical qualifications. While not wishing to express an opinion on this matter, I can recall having seen in the ELECTRICAL REVIEW, not very long ago, an advertisement for a shift charge engineer, in which a B.Sc. degree was one of the stipulated qualifications. Judging by some advertisements, it appears that at least some employers realise that a charge engineer deserves more than the bare schedule rates, and it is to be hoped that where these are given no additional duties are expected.

After reading "but nowadays once a charge engineer always one," my spirits drooped. I suggest that it would not be impossible for arrangements to be made between undertakers, or different departments of the same undertaking, perhaps with the aid of the National Joint Board, whereby a man could be transferred to work involving day duties, after, say, ten years' satisfactory service as a charge engineer. This would, of course, be subject to his having qualified himself technically, but if he knew that there were prospects of a change of duties, and what these were likely to be, he would be able to devote himself wholeheartedly to the study of this particular branch.

I am convinced that if something like this could be arranged it would maintain the flow of good men on to power station operating staffs, and might avoid the anomaly of experienced charge engineers being willing to move their homes, perhaps several hundreds of miles and for little or no financial gain, but solely to obtain experience with a fresh type of plant with the hope that this might be useful at some later date in obtaining a better position. W.

April 29th.

Fourteen years ago, when I decided to take up generation as my particular field of employment, I was warned by an outspoken charge engineer that my choice was ill-advised. I have lived to remember his words and to realise that they were pearls of wisdom.

It is a paradox that the man whose hours are irregular and whose working background is noise, heat and perpetual strain should nevertheless be faced with the longest working week. Day work means a 38- or perhaps a 41-hour week; shift work means 48 hours. At times of sickness or at holiday periods it can often mean much more.

Chiefly, though, it means a groove from which the prospects of escape increasingly diminish. How many chief engineers know the names of the engineers in charge of their power stations, or, for that matter, can condescend to a nod of acknowledgment without the haunting fear that they may be nodding to a switchman?

Shift work is not made easier by the survival of such needless anachronisms as quick change-overs, three-shift rotas and 12-hour shifts. The electricity supply industry can look back on a record of unbroken and unparalleled prosperity; and that record should not be marred by the impaired health of any who have contributed—no matter in how small a degree—to its achievement. Beyond question, years of shift work do result in impaired health and I have yet to meet the engineer on shift duties who is not seeking a way of escape. For a certain day job in the North, advertised recently, every candidate interviewed gave as his reason for being prepared to accept a drop in salary his desire to get off shift work on to a daytime job.

In the present healthy condition of the industry it should not be difficult to devise some scheme whereby engineers would be absorbed into other fields of endeavour after a specified number of years on shift work; and forty or forty-five should be the upper age limit for this kind of employment. Like most other evils of industrial development, night work is accepted too complacently by all except those compelled to engage in it.

The proudest claim for electricity is that it has practically abolished the need for human drudgery. That claim will lose its emphasis unless electricity supply is itself the best example of enlightened industry. COMBUSTION.

April 27th.

I am a charge engineer of 29 years' standing and am at the present in a "super" power station. I would like to explain to "Charge Engineer" how I keep fit.

When on day shift I have a good breakfast and a good dinner when I arrive home at 4 p.m. In the summer I spend most of my off time bowling, motoring and swimming and am thus out of doors most of the time.

When I am on evening shift I go out in the morning for a good walk or swim in the summer. I do not take any food with me on night shift but have a good breakfast when I arrive home. I stay in bed until 5 p.m. when I have my dinner and then play bowls or walk until 8 p.m., returning to prepare for shift at 11 p.m.

In the winter I sometimes patronise the "pictures" when it is raining, or go to a dance. But we engineers must have fresh air, so that at 60 years of age we will still be able to do the same for many years. D. L.

May 2nd.

High-voltage Insulators

Production and testing methods at a Hebburn-on-Tyne factory

Varying properties of raw materials demand elaborate and individual tests which are described

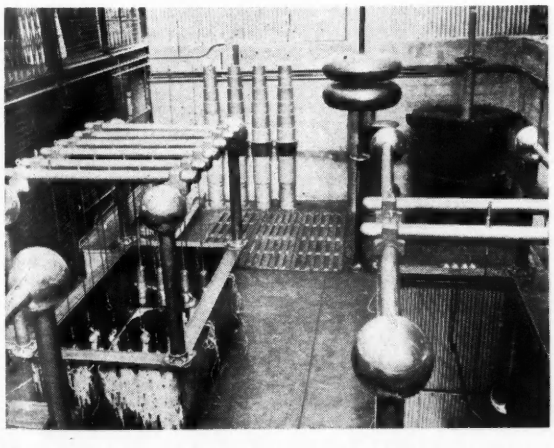
ALTHOUGH the production of bakelised insulators for very high voltages is now well established, ideas as to what constitutes adequate testing are still speculative. This is probably because of the extreme seriousness of the likely results of an insulator failure, of the varying properties of the raw materials available to the insulator manufacturer, and also because of the fact that the methods of production of insulators are to some extent based upon past experience rather than upon exact science. To try, then, to depict what progress has and is being made we publish, by the permission of Mr. G. H. Gardner, general manager, the following brief account of the production and testing methods employed at the works at Hebburn of the Bushing Co., Ltd.

The main raw materials are paper, which is specially selected for its electrical properties, and synthetic resin varnish. Some of the latter is purchased, but considerable quantities are made in a factory completely isolated from the insulator works proper on account of the fire hazard. Quantities of cresol or phenol and formaldehyde are first treated with a catalyst in a still, heat being applied to start a reaction.

A general view of the Bushing Co.'s insulator factory, showing machining lathes in the foreground

It is, however, in the exacting regulation of the temperature of the mixture that successful production lies. The heat is applied electrically and the still is water-jacketed. By means of a load-regulating rheostat and a water tap, the operator can control both heating and cooling so as to obtain the required temperatures continuously throughout the several hours period of treatment. His "governor" is a thermograph on which the chemist has previously plotted a pencil line dictating the temperatures to be followed, and he has to keep the instrument pointer continuously on this line.

After partial cooling the viscous material is run out into trays where final cooling results in solid synthetic resin. This is made into an alcoholic solution in specially designed stirring tanks, the resulting varnish being pumped *via* storage tanks to the works as required.



The main high-voltage testing pit, equipped with air condenser and Schering bridge

In the works the wide paper is first dried on machines in which it passes under and over a series of hot rolls as it is unreeled at one end of the machine and reeled again at the other end. It is next coated with varnish. At one end of the varnishing machine the paper has a film of varnish transferred to it from a roll which picks up the fluid from a trough. The required thickness of the varnish on the paper is determined by passing the paper through a pair of rolls the distance apart of which is under vernier control. An integral part of the machine is a drying oven through which the varnished paper immediately passes. At the far end of the oven the dried varnished paper is again reeled.

Pending their requirement in the factory, the reels of dried varnished paper are stored in a controlled atmosphere in a cork-lined chamber served by an air-conditioning plant, which provides three changes of air per hour and is automatically controlled to afford a relative humidity of about 10 per cent. as required. The varnished paper is then built up and consolidated in the desired formations on mandrels on winding machines. Passage of the paper first over a hot roll renders the varnish soft immediately before winding. The synthetic resins used are "thermo-setting," *i.e.*, they become soft at the first application of heat and then set hard with continued heating. Thus the speed of the machine must be so accurately controlled that setting takes place just at the moment of contact between the two layers on the actual winding cylinder.

Inferior mechanical or electrical properties result from winding too slowly or too quickly. During the winding operation sheets of metallised paper are inserted between layers at predetermined places, and these result in concentrically arranged cylinders in the structure which so grade the electrical stresses throughout the length of the insulator that they follow a straight-line voltage-distance characteristic.

On one machine we saw a long cylinder being wound with five sets of stress-grading concentrics, so that the whole cylinder could be cut up afterwards to make five separate insulators. The wound cylinders are put into ovens for several hours as a normalising treatment. The mandrels are then extracted from the cylinders by machines with motor-driven chain pullers. Rectangular and other sections, too, are wound and sometimes the insulator is built up on the actual conductor to be insulated.

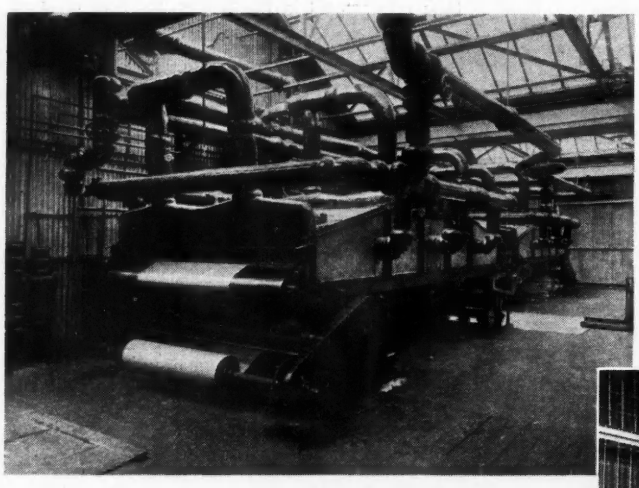
Special Tools

The consolidated units are machined to any required shapes and sizes on metal turning lathes by the aid of special alloy tools. Such special tools are necessary because the low thermal conductivity of the insulating material results in the point of the tool getting very hot. For cutting the material there are in a separate sawmill normal woodworking machines equipped with carborundum wheels and metal-type circular saws with finer settings. Various metal parts and fittings which the insulator has to carry are assembled at this stage, after which three coats of waterproof varnish are given to the insulator. Each coat is applied by spinning the insulator in a lathe and is separately dried in an oven.

The hot rolls, the ovens and the factory and offices (space heating) are all served from an oil-heating installation. The oil is heated in two absorbers of a design similar to that of a normal water-tube boiler and the oil is circulated round the works and back to the absorbers. The outward and return temperatures are about 290 deg. C. and 260 deg. C. Various heat-exchange systems are provided throughout the installation. For instance, ovens are heated by air blown through hot-oil radiators, while for space heating heat from the oil is passed to subsidiary hot-water equipment.

Products of the factory range from small insulating tubes up to large condenser bushing insulators for, say, 200,000 V. It is, of course, the products at the latter end of the range for which the very stringent tests are prescribed.

Broadly speaking, these tests may be considered in two main classes—type and routine. Every individual insulator is subjected to the routine tests, while the type test is one to destruction and is carried out on at least one insulator for every order and on one per cent. of the insulators of a big order. The type tests are air flash-over or oil flash-over, according to the use to which the insulator is to be put, and the puncture test. After the insulator is set up the voltage imposed is raised higher and higher until the insulator is destroyed. The voltmeter is calibrated by sphere-gap settings, intervals being allowed in the case of individual tests for heat dissipation. A



22-kV switch bushing which we saw subjected to a type test in oil actually "gave out" by complete flash-over at 124,000 V.

Destruction takes place by a flash over the surface or a puncture through the body of the material, and the voltage at which breakdown takes place must be higher than a specified voltage for which the insulator is designed. Often an insulator on test cannot be punctured because breakdown takes place longitudinally, wholly as a surface flash-over or partly as a surface flash-over and partly along the laminæ of the material.

The object of the routine tests is to make sure that each individual insulator is made from good material and contains no manufacturing faults. Devising the tests is very difficult because it is necessary to ensure that the imposition of the test does not cause damage to the insulator under test. The routine tests are thermal, ionisation, over-potential, hissing, surge, mechanical and material.

The thermal test is designed to detect the tendency of the insulator to thermal instability. Heat is generated in an insulator by the dielectric loss, and unless dissipated this heat will raise the temperature of the material. If the temperature rises too high, destruction by burning will result. The test is made by raising the temperature of the insulator to the highest point it is likely to attain in service, then applying a voltage (usually twice the working pressure) and finally measuring the dielectric losses by a Schering bridge. The test is continued for some hours and as the temperature of the insulator rises so does the dielectric loss. If the insulator is a good one the heat generated will be dissipated from the surface and after a time the losses will become constant. If the insulator is unstable the losses will continue to increase with time and breakdown will eventually occur.

Ionisation Tests

If internal ionisation takes place in the insulating material breakdown will result in time. One effect of ionisation is to increase the power factor of the insulator so that by measuring the power factor at different voltages one can detect the particular voltage at which ionisation commences. Power factor or phase angle of an insulator is determined by balancing the condenser capacitance (insulators are really leaky condensers) with that of known-value condensers. The principal object of the test is to ensure that each insulator is free from ionisation at a voltage of 25 per cent. greater than the working voltage.

In the over-potential test each insulator is subjected for one minute to a voltage of approximately four times the working voltage (*i.e.*, $1/\sqrt{3}$ line voltage). A milliameter is put in circuit to indicate the current during the test and this has to remain at a steady value. The test has to be applied with great care to ensure that the high pressure imposed does not impair the quality of the insulating material.

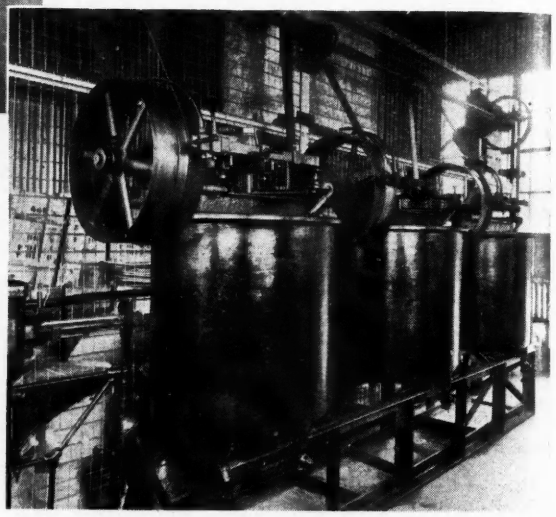
The hissing test is often specified with the object of detecting the presence of internal ionisation which is very often audible. The test can be made either by actually listening for the sound or by electrical detection. In the audible method the insulator is tested in a sound-proof room. A sufficiently high voltage to commence the hissing is imposed on the insulator and the testing engineer then, by the aid of a listening tube, actually detects by ear the progressive lessening of the noise as the applied voltage is reduced until the hissing can no longer be heard. The voltage at which the insulator becomes silent must be at least higher than the working voltage. By means of amplification the hissing can be detected by earphones with very much greater accuracy, and a still more modern equipment provides for visual indication of the hissing.

As insulators are frequently required to withstand mechanical shock in service, tests have been designed to simulate working conditions and impose, say, double

Paper-varnishing machine incorporating drying oven

the expected service mechanical loading. This test is carried out after the electrical tests, which are then duplicated after the mechanical tests. If any strain has been caused by the mechanical test there will be a difference between the results of the duplicated electrical tests.

Insulators are sometimes subjected to impulse surges



A battery of varnish mixers

to check the surge characteristics against the possible magnitude of impulse surges likely to be encountered in service.

During the process of manufacture material tests are constantly being made to ensure that the quality of the material is consistently high. Test samples are prepared from each batch of insulators and subjected to electrical, mechanical and physical tests while tests are also made to prove the efficiency of the varnish finish. Close supervision in every part of the manufacturing process prevents deviation from the process specifications laid down by the technical department and ensures that each insulator produced is manufactured in the approved manner.

We are indebted to Mr. W. J. Brown, chief engineer and chief of the research department, for assistance in compiling these notes.

Extensions to Electricity Offices

The Hammersmith Borough Council has acquired property adjoining its electricity showrooms and offices at 154, Uxbridge Road, to provide additional office and other accommodation for the Electricity Department. There are three buildings on the site. The ground floor of one will be used for stores, and the first floor as an extension of the general office over the existing showrooms. The front portion of the main building will house the staff and employés of the Meter Section, the first floor being used as a meter test room and the ground floor for meter repairing, reading, inspecting and office staff, &c. The remaining part of the building will be used for the Consumers' Installation Section. The third building will be used as a garage for the transport vehicles of the Department.

Timing London's Buses

An L.P.T.B. experiment

ELECTRICALLY operated methods of recording the service interval, or "headway," between successive vehicles have been in use on the tube railways, tramways and trolley-bus routes of the London Passenger Transport Board for some little time, and have proved of great assistance in the control of traffic movements and the reduction of wasted time.

In the case of motor-omnibus routes there are no running rails or conductor wires to serve as the means of completing contacts for operating the recorder; some other system was needed, and that selected for experiment employs electrical induction between the moving vehicles and actuating circuits fixed at chosen points along the route, which are energised by the passage of the vehicles, and trip relays which operate the recorders.

The bus installation consists of a frame, about 4 ft. square, mounted on the roof and wound with fifteen

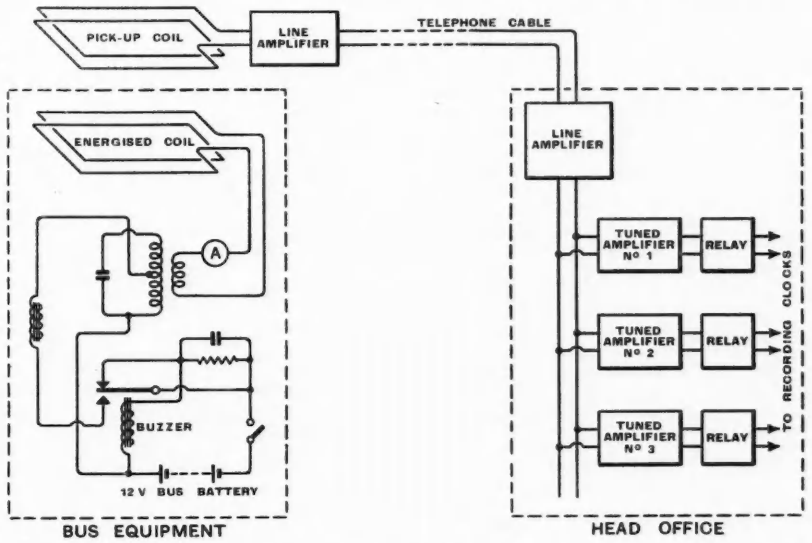
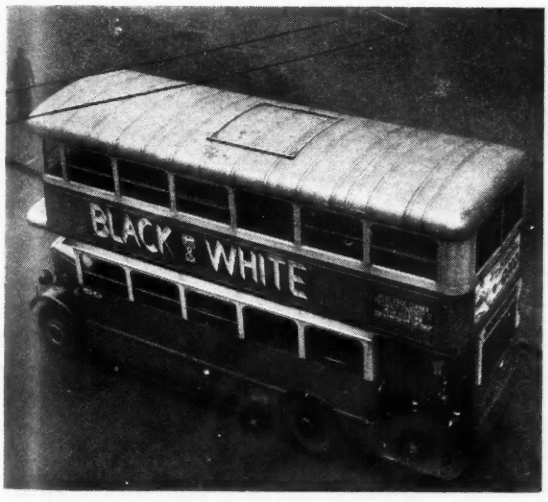


Diagram showing the operation of the system

turns of wire. The ends of this winding are connected to an energising unit, which is made up of a buzzer and a transformer, both supplied with d.c. from the normal accumulator battery of the vehicle, and the necessary choke, condensers, switches and other small components needed for spark-elimination and tuning. The reed of the buzzer is adjusted to vibrate at a definite frequency, and serves a dual purpose. It is connected to one pole of the battery and moves between two contacts, one of which is in the circuit of the buzzer magnet, and maintains the vibration of the reed. The other contact is connected, through a choke, to the primary winding of the transformer, and the trembler action of the reed therefore serves to interrupt the battery current in this primary winding. By



A bus passing under the pick-up arrangement

this means the 12-V accumulator is employed to produce interrupted current of known frequency in the secondary of the transformer, and it is this secondary current which is used to supply the energiser-coil on the bus roof.

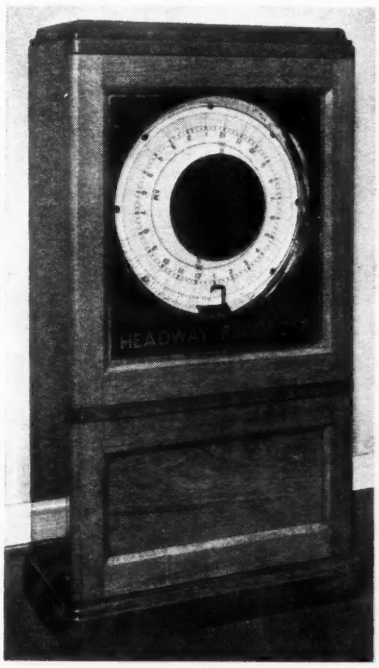
The transformer circuits are tuned to match the frequency of the buzzer, partly in order to get efficient action, but also for another purpose, which will be dealt with later. The buzzer and associated equipment are mounted in a cast metal casing and clipped into place on a plate fitted to the bus. The "pick-up coil," consisting of 100 turns of wire, is erected across the roadway at the point where a record is required, and leads from it are taken to a thermionic-valve amplifier situated close by.

As each omnibus fitted with an inductor passes under the pick-up coil, current is induced in the latter, and, magnified by the amplifier, is conducted to a further amplifier at the recording point.

After the second stage of amplification the current impulses are passed to a tuned amplifier and the output from which is connected to the relay which operates the stamping mechanism of the headway recorder. The latter is of a very similar type to those already in service on the tube railways. A powerful clock movement of the spring-driven, lever escapement type rotates a main spindle once in 24 hours, and on this spindle is mounted the recording dial, a paper disc suitably marked out in time divisions. A hammer with an inked acting-face is fitted opposite the lowest point of the dial, and the tripping of the relay contacts causes this to rise sharply and print a mark on the paper disc alongside the time marking representing the instant of imprint.

With correct headway between successive vehicles, the stampings will be evenly spaced, but delays or irregularities will be at once apparent by the displacement of the markings. The recorder therefore gives a clear indication of the service conditions, and, in addition, affords a permanent record, in the form of the stamped disc, which can be filed for future reference.

It was mentioned earlier that the buzzer-reed and transformer circuits, as well as the final stage amplifier, were tuned to a definite frequency. The purpose of this is to enable one "receiving point" to deal with the recording of several routes. By connecting several tuned amplifiers in parallel to the output side of the second-stage amplifier, tuning each of these to a different frequency and adjusting the bus energiser units to synchronise with the tuned amplifiers of their own particular routes, impulses from a number of routes can be received by the same coil and afterwards diverted to operate the particular relay of the correct



A headway recorder

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Wear and Tear Allowances

Referring to our last week's notes upon the Budget, it should be made clear that the increase from 10 to 20 per cent. in the allowance for the wear and tear of machinery is on the standard rates. Useful tables detailing the standard, existing and proposed rates were published last week by the *Financial Times*. The standard rates have been agreed between the Board of Inland Revenue and various trade associations, subject to approval by the general or special commissioners concerned.

One table, covering the general plant and machinery commonly used in a number of different trades, businesses and professions includes electrical plant and machinery for which the standard rate is 7½ per cent., the present rate 8¼ per cent., and the proposed rate 9 per cent. In a further table our contemporary sets out similar information in respect of a number of specific industries. From this we have extracted the following items of electrical interest:—

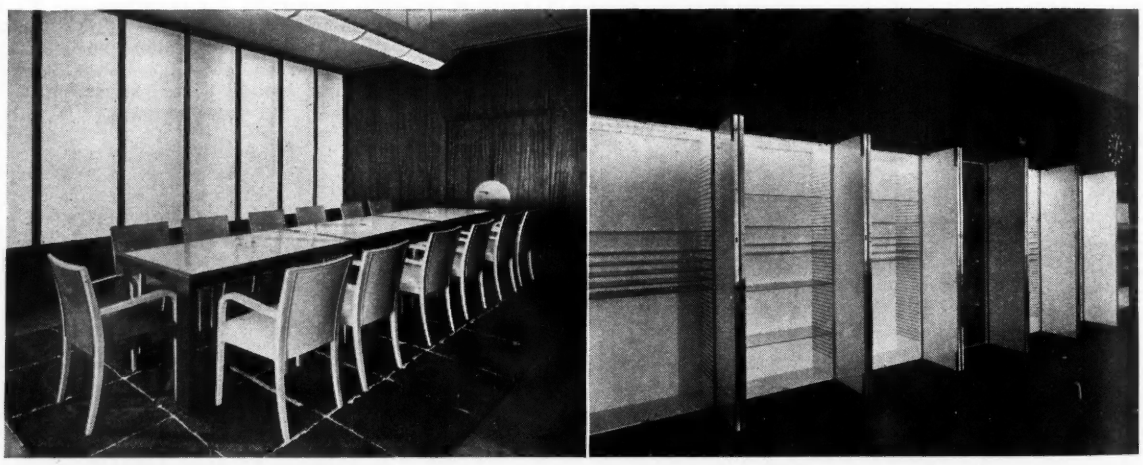
Industry.	Standard Rates %	Present Rate %	Proposed Rates %	Nature of Plant.
Chemical	7½	8¼	9	Electrical plant.
Collieries	7½	8¼	9	Electrical plant at surface and underground plant installed in shaft pillar.
Cutlery and cutlery blank.	7½	8¼	9	Electric motors and knife-grinding machines, etc.
Electricity supply undertakings...	3	3.3	3.6	Cables.
,, ,, ...	5	5½	6	Plant and machinery.
,, ,, ...	20	22	24	Cookers, kettles, etc., on hire to consumers.
,, ,, ...	15	16½	18	Refrigerators, washing machines, water heaters, etc.
,, ,, ...	10	11	12	Other apparatus.
Engineering ...	5	5½	6	Forging, rolling, drawing, shearing and bending machinery.
,, (general)	7½	8¼	9	Machine tools generally, moulding, woodworking and sheet metal plant.
,, ,,	7	7.7	8.4	Brass foundry, drop forging and stamping plant.
,, ,,	12½	13¾	15	Special precision and tool-room plant, electric furnaces and switchgear.
Flour milling ...	7½	8¼	9	Electric motors and other electrical plant.
Iron and steel ...	12½	13¾	15	Electric furnaces and switchgear.

Fluorescence on the Stage

At the invitation of the Electrical Development Association we attended on Friday last an informal party on the stage at the Alhambra Theatre, Glasgow, at the conclusion of the evening performance of "Crest of the Wave," held in compliment to the opening of the Empire Exhibition. Mr. Ivor Novello and Miss Dorothy Dickson, who take leading parts in the play, acted as host and hostess. Advance which has been made in the application of the ultra-violet mercury-vapour lamp with a Wood's-glass bulb for filtering the visible rays was shown with marked effect. The luminous-powder treated trimming of a lady dancer's dress, shoes and hair ornamentation and of her partner's collar and tie and shoes resulted in a remarkable effect of illuminated shadows. Subsequently amid a bevy of stage beauty, at closer inspection of the lamps, some of the effects were not quite so pleasing. For instance, while the owners of perfect natural teeth could proudly display them, the tell-tale effect on non-phosphorus bearing artificial teeth and stoppings was hardly fair. But the significance of the demonstrations was the obviously tremendous possibilities of the filtered ultra-violet lamp for stage and other work. Big possibilities of electric lighting in other directions, particularly street lighting, perhaps, were also evident as the result of a demonstration of the new 250-W compact source high brightness lamp. It does not employ water cooling. As a result of this the lamp has to be nearly spherical in shape. The envelope is entirely of quartz and the brightness is higher than that obtainable from a water-cooled lamp of the same wattage and life. The shape of the source is about 3 mm. long and 1 mm. wide. The brightness is about 25,000 candles per sq. cm. The compact source-type lamp operates without transformer directly on 200-260-V supplies. A series choke is needed for a.c. and a series resistance for d.c. operation. The life is at least 500 hours.

Modern Board Room Lighting

An interesting lighting installation has recently been carried out in the board room of Imperial Chemical Industries, Ltd., by G.V.D. Illuminators, Ltd. A distinctive feature of the installation is the large window occupying the whole of one side of the room. This is constructed as a double window and between the inner and outer frames special G.V.D. reflectors are installed, so that the window is as evenly illuminated at night as during daylight. Another feature is the lighting of the cupboards, only one lamp being used in each of these.



The G.V.D. installation in the board room of I.C.I., Ltd., and (right) the lighting of the cupboards

Timing London's Buses (*Concluded from preceding page*)

recorder without affecting the other relays in the system.

The experimental installation is in operation at the omnibus station at Victoria Station, London, and the recorder is in a control office at the L.P.T.B. head offices at Westminster, the connecting wires running through the Underground Railway tunnel between Victoria and St. James' Park stations. Omnibuses on Route 44 are being used for timing purposes, the recording taking place as the vehicles enter the station.

If the system proves sufficiently serviceable for general application many routes in Central London areas are likely to be timed in this way, pick-up coils being erected at various points, and connecting wires run through the tube tunnels to some convenient control point. To overcome the objections which may be raised to the overhead wiring of the pick-up coils, an alternative arrangement which uses a pick-up coil placed beneath the road surface and an energiser-coil below the bus has been designed. This has also proved quite satisfactory.

The units, being of the plug-in type, can be easily changed when required, and so the alterations necessary when a bus is changed over from one route to another can be simply done. Units pre-tuned to the selected frequencies for each route can be kept in stock and mounted on the vehicles as necessary. The buzzers run continuously while the bus is on the road, although the recording only takes place at certain points. Frequencies from 100 cycles upwards are used, and no trouble is experienced either from interference with other circuits or from the effects of external fields on the recorders. In operation, the scheme has proved quite satisfactory in its present form and the experiment is being continued and developed.

Electricity on the Farm

Complaints of delay in bringing electricity supplies to farms were aired at a recent meeting of Bletchley (Northants) branch of the National Farmers' Union. A circular letter received from the Union headquarters stated that the commercial committee had expressed great disappointment that the Government had been unable to proceed with the Electricity Bill in the present session and had expressed increasing concern at the small number of farmers who enjoyed the benefits of electricity and at the slow progress of farm electrification. The chairman told the meeting that he paid 8d. per kWh for his supply. Another member said that when he applied for a supply he was told that he would have to pay for a transformer, at a prohibitive cost, and guarantee a certain consumption per annum. Electricity was no longer a luxury, it was a necessity, and it was wrong in these days for farmers to be deprived of that necessity. The chairman remarked that the companies did not seem to be keeping their part of the bargain, which was to give a supply to the rural districts. The National Farmers' Union seemed alive to the position and a committee had been appointed to interview the Minister of Transport on the matter.

Works Visits

On April 27th members of the Manchester branch of the Association of Supervising Electrical Engineers visited the works of T. Wall & Son, Ltd., at Godley, Hyde, Cheshire. The party was met at the works by Mr. P. Maloney, the works engineer, who conducted the tour and explained the manufacture of ice-cream on a large scale by electrically driven machinery. An interesting feature of the plant was the use of both a.c. and d.c. supply.

The last monthly meeting of the E.D.A. Central England Staffs Committee was held recently at the Rugby works of the British Thomson-Houston Co., Ltd. After the business meeting in the morning and a talk on the Association's refrigeration campaign given by Mr. E. G. Plucknett, manager of the Electricity Supply Division of the International Refrigerator Co., Ltd., the party took lunch in the B.T.H. restaurant. Mr. A. P. Young, manager of the Rugby works, presided. During the afternoon the party went over the home appliance factory and saw refrigerators in process of manufacture and assembly.

A party of students from Bury St. Edmund's Technical College visited Callender's cable works at Belvedere on April 28th under the guidance of Mr. G. E. Gregg, mains engineer, Bury Electricity Department. They saw the various stages of cable making, including impregnating, lead press, armouring and testing, and after lunch visited the foundry and engineering shops. During lunch Mr. Gregg voiced the thanks of the party to Callender's, and Mr. W. F. Slater (joint works manager) responded. The party completed the day with a few hours in London.

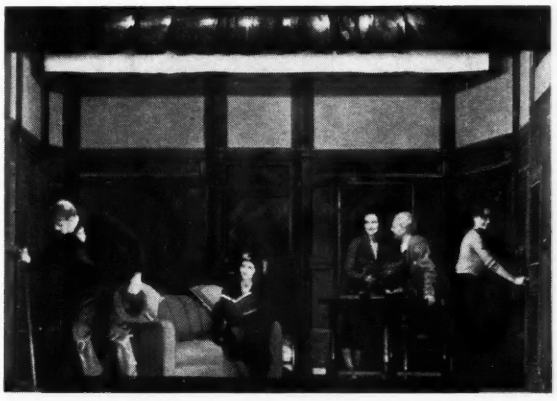
Price Reductions

Crompton Parkinson, Ltd., announce that they have reduced the prices of their complete range of silvered show window reflectors.

Social Events

Nearly 1,000 employés and friends of the Union Cable Co., Ltd., and the Southern United Telephone Cables, Ltd., attended a concert at the Town Hall, East Ham, on April 30th, by the invitation of Mr. J. Snow Huddleston, M.I.E.E., managing director, who is also president of the Dagenham Cables Sports Club, the members of which are employés of the two companies. An excellent programme by well-known artistes was thoroughly enjoyed by all present. During the interval Mr. Huddleston introduced a "chicken" which was usefully employed on behalf of the egg fund of King George Hospital, Ilford. On behalf of the large audience Mr. C. F. Street thanked the president for an enjoyable evening.

The Norwich Electricity Players, a recently formed section of the Norwich Corporation Electricity Department Sports Club, successfully presented Frank Vosper's play, "Love from a Stranger," at the Martineau Hall, Norwich, on Wednesday, Thursday and Friday of last week. The play was produced by Mr. A. J. Eagle, of the Reepham District Office, with a cast drawn from all departments of the undertaking. The part of "Bruce Lovell" was realistically played by Mr. B. Ward, of the constructional office, opposite to whom was Miss A. Riches, making an attractive "Cecily Harrington." Mr. J. Liddament made a vigorous "Nigel Lawrence," backed up by Miss D. Gibson, who faithfully portrayed "Auntie Loo Loo," and Miss



Members of Norwich Electricity Department in a scene from "Love from a Stranger," which they recently presented at the Martineau Hall, Norwich

I. Turner, who made a pleasing "Mavis Wilson." Mr. A. C. Thirtle, the generation engineer, was consistently good as "Dr. Gribble," while Mr. C. Horrocks, of the office staff, made a realistic rheumatic gardener, and Miss V. Burridge amusingly characterised the typical raw country maid. The stage management and lighting were in the hands of Mr. K. K. Smith, assisted by Messrs. W. W. Foxen and J. Bullock, all of the city mains department.

L.P.T.B. Wages

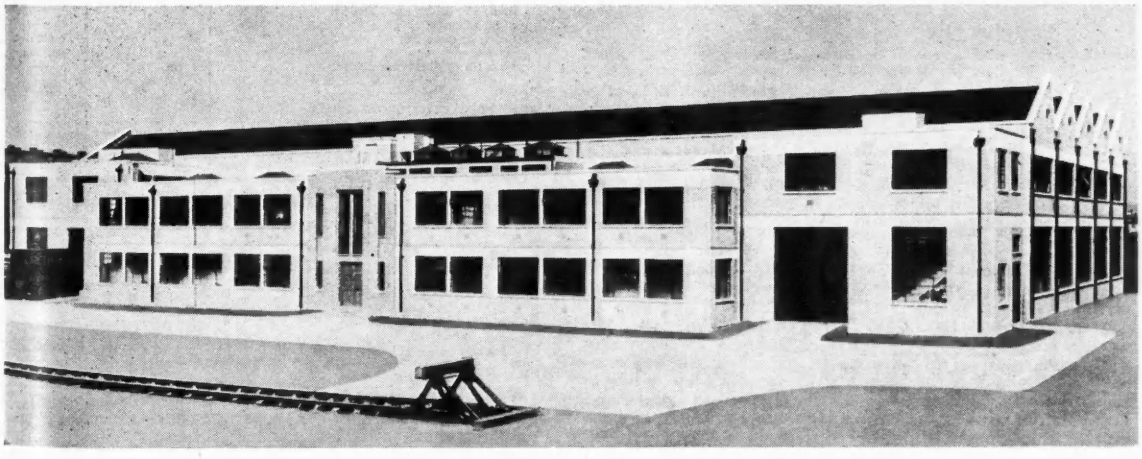
The wages of electrical employés of the London Passenger Transport Board employed in the tramcar and trolley-bus power production and distribution sections are to be advanced by ½d. per hour as and from November 20th, 1937. This is the award of Mr. J. Forster, who recently sat as independent chairman at a meeting of the Joint Negotiating Committee in connection with a wages claim which had been submitted by the trade unions.

Orders Recently Booked

Elliott Brothers (London), Ltd., have received an order for instruments and equipment for the *Queen Elizabeth* similar to those already supplied and installed in the *Queen Mary*. The order comprises twelve complete sets of CO_2 (flue gas analysis) equipment, *i.e.*, one set for each of the main boilers; a 21-way temperature indicator with selector switch and electrical distance thermometers for the provision stores; and four directional engine revolution indicators to measure the speed and indicate the direction of each of the propellor shafts.

Recently Smith bi-synchronous master clock systems have been installed in two prominent buildings—Queen Mary's Nurses' Home, Westminster, and the Dudley Road Hospital, Birmingham. London's new county offices, the first section of which is rapidly taking shape, will also be equipped with a complete time service of "Sectric" clocks. In the section now under construction there will be two Smith bi-synchronous master clock systems with three hundred "slave" dials, a test board to hold twenty-five "Sectric" clocks, and other timing apparatus.

"Osira" mercury electric-discharge lamps are to be used



The new "Coldair" refrigerator factory on the G.E.C. Wembley Estate **(see page 648)**

for road lighting in the Iranian Desert, Persia. The General Electric Co., Ltd., is supplying over 100 125-W lamps and equipment for illuminating a stretch of roadway a little over three miles long linking up one of the Anglo-Iranian Oil Co.'s refineries with a neighbouring township. G.E.C. silvered glass reflector units of a special design will be used. They will be of a similar type to those installed at Tilbury and at the West India Docks for the Port of London Authority.

Dutch Foreign Electrical Trade

Import and export figures for electrical material published by the Dutch Treasury Department indicate a general improvement. In some cases this has been very considerable, especially as regards the export of radio sets and parts, and electric lamps. Exports of radio sets amounted to 52,654,000 fl. in 1937 against 34,437,000 fl. in 1936, while exports of incandescent lamps rose from 5,586,000 fl. in 1936 to 7,377,000 fl. in 1937. Other important increases in exports include insulated wires and cables from 1,575,000 fl. to 3,626,000 fl.; and large electric motors from 637,000 fl. to 1,298,000 fl. Total exports of electrical apparatus amounted to 73,259,000 fl. in 1937 against 48,001,000 fl. in 1936. On the import side a somewhat smaller expansion is noted. The greatest increase was in radio sets and parts, which were imported to a value of 9,125,000 fl. against 7,918,000 fl. in 1936. Imports of large electric motors were more than doubled, at 1,776,000 fl. against 822,000 fl. in 1936. Other improvements included telegraph and telephone equipment, which rose from 3,432,000 fl. to 5,197,000 fl., insulated wires and cables, which increased from 2,425,000 fl. to 3,683,000 fl., and electric generators and parts for which the value of imports increased from 667,000 fl. to 1,218,000 fl. Total electrical imports stood last year at 34,732,000 fl. against 24,413,000 fl. in 1936.

Electrical Exhibition at Harrow

An Electric Home Exhibition was opened yesterday at the Victoria Hall, Station Road, Harrow, by the North Metropolitan Electric Supply Co. and will continue until Saturday, May 14th. Two electric cooking demonstrations are being given daily at 3.30 p.m. and 8 p.m. The first demonstration was "Automatic Cooking," indicating the progress which has been made in thermostatic control. There is a complete display of electrical appliances and free competitions are held daily.

Fire at Switchgear Works

A fire occurred at one of the Banbury factories of Switchgear & Equipment, Ltd., on the night of April 29th. The conflagration was confined to a comparatively small section of the Kiosk Department and to a sectional drawing office related thereto. Fortunately, the company was able to secure the immediate services of J. L. Eve Construction Co., Ltd., which

The Kiosk Department of Switchgear & Equipment, Ltd., after the recent fire

is building the company's new factory at Banbury, and by working throughout the week-end it was able to have the debris cleared and the burnt-out portion of the factory sufficiently reconstructed to enable it to get into full production on Tuesday morning this week.

Trade Commissioners' Visit

The Department of Overseas Trade announces that Mr. W. D. Lambie, H.M. Trade Commissioner at Trinidad, and Mr. J. L. Wilson Goode, H.M. Trade Commissioner at Vancouver, are at present in this country on an official visit. Mr. Lambie will be at the Department of Overseas Trade on May 23rd for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to the British West Indies (except Jamaica), British Guiana and Bermuda, after which he will undertake a short tour of some of the more important industrial centres in the provinces. Mr. Wilson Goode will be available at the Department for the period May 11th-13th, with a view to interviewing manufacturers and merchants interested in the export of goods to Alberta and British Columbia, after which he will also visit the provinces. Firms wishing to interview Mr. Lambie in London or to obtain information regarding his arrangements to visit the provinces should apply to the Department of Overseas Trade, 35, Old Queen Street, S.W.1, quoting reference 21123-38. Similar information regarding Mr. Wilson Goode can be obtained on quoting reference 20872/38.

A Refrigerator Display

The British Power & Light Corporation, Ltd., through its subsidiary, the North Wales Power Co., Ltd., recently opened a new showroom at Llangefni, and to mark the occasion held

A display of refrigerators by the British Power & Light Corporation, Ltd., at an electrical exhibition at Llangefni

an electrical exhibition in the district. As our picture shows the Corporation's stand was devoted to a display of refrigerators for commercial and domestic use.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price May 4th	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4½d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll... ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£166	—
Grade II ... ... ,,	£119	—
Grade III... ... ... ,,	£69	—
c Brass (rolled metal 2" to 12" basis)... per lb.	7¾d.	¼d. dec.
c ,, Tubes (solid drawn) ... ... ,,	11d. to 11¼d.	—
c ,, Wire, basis ... ... ,,	8¼d.	¼d. dec.
c Copper Tubes (solid drawn) ... ,,	1/0½	—
g ,, Bars (best selected)... ... per ton	£73	£2 dec.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£43 15s.	—
d ,, ,, Wire Rods ... ,,	£48 5s.	—
d ,, ,, H.C. Wire ... per lb.	7 1/16d.	—
f Ebonite Rod ¼" dia. & up ... ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	5½d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£16 10s.	£1 5s. dec.
g Mercury ... ... per bot.	£12	10s. dec.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e ,, ,, ,, medium ... ,,	6/– to 12/6	—
e ,, ,, ,, large ... ,,	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1½	—
p ,, ,, rolled strip & sheet ,,	10½d.	—
p ,, ,, wire ... ... ,,	1/0½d.	½d. dec.
o Platinum ... ... per oz.	£6 12s. 6d.	7s. 6d dec.
d Silicium Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£12 12s. 6d.	£1 5s. dec.
g Tin, Block (English)... ... ... per ton	£153 5s.	£17 15s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Practical Notes on Switchgear

Material contained in four booklets issued by George Ellison, Ltd., has been revised and brought together, with the addition of formulæ and useful data, in one volume of 175 pages, including 63 figures and a serviceable index. The "Ellison Handbook" provides concise information on ordering, installing and maintaining all types of Ellison switchgear, but its appeal is not limited to users of one make, as many of the hints given have a general significance. Included in these are the statement of particulars that should be given in specifications, rectifying faults in motor control gear, and twenty-four pages of diagrams of connections. Among the data are given the current taken by various sizes and types of motors, the carrying capacities of cables and the space required by common sizes of transformers and switch units. A nominal charge of 2s. is made for the book.

Pye Appliances

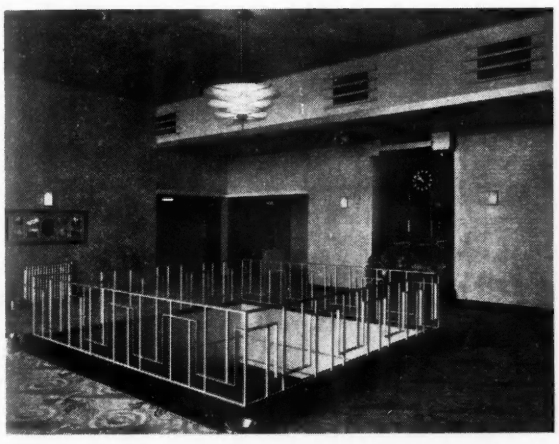
Pye, Ltd., has issued an attractive catalogue illustrating a range of domestic electrical appliances which it is now marketing under the name of "Pye Electric Age." The range includes "table-chefs," toasters, percolators and coffee-makers, irons, mixer-beaters, bed-warmers, vacuum cleaners, washing machines, refrigerators and shaving mirrors. The company has prepared a hire-purchase selling plan for appliances over £5, and is supplying small window or counter displays free with each order for four appliances.

A Guide to the Empire Exhibition

Scottish Cables, Ltd., has issued a booklet announcing that coincident with the opening of the Empire Exhibition at Glasgow it has gone into production. A comprehensive range of its products are displayed on stand E.50 in the Palace of Engineering. A good deal of information useful to visitors to the exhibition is given, including a calendar of the chief events during the run of the exhibition, a plan showing the main buildings, lists of private and public golf courses, restaurants, &c., and a map of the Midlands of Scotland.

A Cinema Lighting Installation

The new Orpheus Cinema at Henleaze, Bristol, built to the designs of Mr. A. F. French, for the Orpheus Kinema Co., Ltd., to accommodate 1,500 people, is an attractive structure with artificial stone frontage effectively illuminated by G.E.C. floodlights, and its sign is outlined by Cleora fluorescent tubing in green and amber. Fluorescent tube lighting is also used as a decorative medium for the front of the building, amber coloured tubes being employed around the canopy with vertical lines of green above and below it. The treatment is somewhat unusual, in that the tubing below the canopy runs down to ground level, being protected by frosted glass fittings.



G.E.C. lighting of the balcony foyer at the Orpheus Cinema, Bristol

Over 500 ft. of tubing is employed in the scheme. Inside the cinema recessed lighting fittings incorporating 18-in. discs with red metalwork are fitted into plaster features, and provide a pleasing form of illumination in the entrance foyer. The staircases, entrances and exits are illuminated by ceiling fittings, and a specially designed 3-tier lighting fitting is installed over the well in the balcony foyer. Over-balcony lighting is carried out by wall brackets, while the under-balcony illumination is contrived by twenty circular recessed fittings. The under-balcony columns also carry special lighting features. For the illumination of the auditorium trough lighting is arranged in a series of coves—one over the proscenium arch and three in the main ceiling. For this G.E.C. troughing and 40-W "Osram" lamps are used. This lighting is supplemented by glass wall soffits housing trough reflectors and 15-W lamps. The stage lighting is by an arrangement of batteries, footlights and floods. A G.E.C. 10-way dimmer board controls this as well as the auditorium lighting. An 8-line intercommunication telephone system operates throughout the building. Other electrical equipment supplied by the G.E.C. included secondary lighting apparatus, all switchgear, cables and conduits, electric clocks and the floodlights for the car park. The Colston Electrical Co., Ltd., of Bristol, were the electrical contractors.

New Catalogues and Lists

Alkium Storage Batteries, Ltd., Waterside Works, Halifax.—An illustrated art booklet dealing with emergency lighting, including wiring diagrams.

Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, London, W.C.2.—A pocket price list of motors and control gear.

Enfield Cable Works, Ltd., Lincoln House, High Holborn, London, W.C.1.—A stock list of cables, &c.

Constructors, Ltd., Nickel Works, Tyburn Road, Erdington, Birmingham.—A leaflet dealing with local gas mask stores.

C.A.V.-Bosch, Ltd., Acton, London, W.3.—A catalogue of switchboards, switch panels and control boards for motor vehicles.

Igranic Electric Co., Ltd., Bedford.—A revised 40-page illustrated catalogue of control gear for electric motors. A thumb index is provided.

Marelli & Co., Ltd., Artillery House, Artillery Row, Victoria Street, London, S.W.1.—A catalogue of electric fans.

Air Conditioning & Engineering, Ltd., 123D, Victoria Street, London, S.W.1.—A leaflet describing small "Delco" blowers and fans.

Higgs Motors, Ltd., Witton, Birmingham.—A broadsheet taking the form of a letter advertising totally enclosed motors.

Metropolitan Electric Supplies, Exchange House, Old Change, London, E.C.—A card price list of conduit accessories and elements.

Bankruptcy Proceedings

G. Linds, 4, Red Lion Street, Holborn, W.C., electrical contractor.—This debtor attended at the London Bankruptcy Court for his adjourned public examination before Mr. Registrar Parton on April 29th. He failed in January last with liabilities of £810 and no assets, and the previous hearing had been adjourned in order that debtor might comply with the Registrar's order and make out in duplicate and submit to the Official Receiver a cash and goods account. Debtor was questioned by the Official Receiver upon this account and the examination was then adjourned *sine die*, the Registrar remarking that debtor had failed to give a frank and satisfactory account of his affairs.

R. R. French, Chandos Place, St. Austell, Cornwall, trading as Radio Electrical Services, radio dealer.—This debtor appeared for public examination on April 25th at the Town Hall, Truro, when it was reported that the deficiency amounted to £725. Debtor attributed his present position to insufficient capital, defaulters under hire-purchase agreements, loss on resale of second-hand sets and payment of heavy rent and rates. The examination was closed.

L. A. W. Steinmetz, electrical dealer, 56, Bromham Road, Bedford.—Application for discharge to be heard on May 25th at the Shire Hall, Bedford.

S. S. West and **L. A. Brown** (Webro Electrical Contractors), electrical engineers, 41, Goodge Street, W.1.—Last day for receiving proofs for dividend May 16th. Trustee, Mr. C. B. Park, Carey Street, W.C.2, Official Receiver.

E. B. Clendinnen, radio dealer, 111, Wolverhampton Road, Stafford.—Trustee, Mr. S. Shemmell, 16, Darlington Street, Wolverhampton (in place of Mr. F. E. Bendall), appointed April 21st.

Company Liquidations

Blooms Radio, Ltd., 35, Caroline Street, Bridgend, and at Swansea, Neath and Tonypandy, wireless dealers.—The statutory meeting of creditors was held recently at Cardiff, when it was reported that the shareholders had passed the usual resolution for the voluntary liquidation of the company and had nominated Mr. L. S. Findlay, of Messrs. Poppleton & Appleby, 35, Windsor Place, Cardiff, as liquidator. A statement of affairs as at April 2nd was submitted, showing liabilities of £38,595, of which £3,753 was due to unsecured creditors, and finance companies were partly secured creditors. Their total claims were £34,947, against which they held debts estimated at £50,000, and monies in trust, £105, leaving them unsecured for £34,842. The net assets were £3,424, leaving an estimated deficiency as regards creditors of £35,171. The solicitor to the company reported that after consultation with the principal hire-purchase companies he was in a position to inform the creditors that provided the liquidator allowed the finance companies immediate facilities for taking over the hire-purchase records, thus enabling the finance companies to make arrangements for the continuance of the payments by the hirers, they would, with the exception of one creditor for £2,367, withdraw their claims against the company. It was resolved to confirm the voluntary liquidation of the company with Mr. L. A. Findlay as liquidator. A committee of inspection was also appointed.

May's Radio, Ltd., 79, Walworth Road, London, S.E.17.—Pursuant to Section 238 of the Companies Act, 1929, a meeting of the creditors was held recently when a statement of affairs was submitted showing liabilities of £1,082, while after allowing £90 for preferential claims the net assets were £41, leaving a deficiency, as regarded the creditors, of £1,041. The shareholders had previously met and passed the usual resolution placing the company into voluntary liquidation with Mr. L. Grahame, of Bright, Grahame & Co., 46a, Finsbury Square, London, E.C., as liquidator. There was no counter proposal on the part of the creditors, and the voluntary liquidation of the company will be continued by Mr. Grahame.

Philradio Electric, Ltd.—Winding up voluntarily. Liquidator, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

T. X. Products Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. W. Inns, Finsbury Court, Finsbury Pavement, E.C.2. Particulars of claims to the liquidator by May 26th.

J. R. Offer & Son, Ltd.—Winding up voluntarily. Liquidators, Mr. C. G. Graves, 12, Clarence Street, Kingston-on-Thames, and Mr. A. E. Quaife, 104, High Holborn, W.C.

Milnes Radio Co., Ltd.—Particulars of claims by May 17th to the liquidator, Mr. W. Driver, 63, Great George Street, Leeds, 1.

Cowtan & Sons, Ltd.—Winding up voluntarily. Liquidator, Mr. R. Stephens, 31, Lombard Street, E.C.

Electricity Supply

Lighting, Domestic, Power

Accrington.—EQUIPMENT AT THE MARKET HALL.—In the reorganisation of the Market Hall an electric lift is to be provided and new heating arrangements are to be introduced.

Algeria.—ELECTRICAL PROGRESS.—Steady progress continues to be made in the output of electricity. Evidence of this is afforded by the report for last year of the Société Algérienne d'Eclairage et de Force, which shows that the quantity of power supplied in the Algiers district increased from 47 million kWh in 1936 to 53.2 million kWh last year and in the Oran area from 28.8 million kWh to 29.3 million kWh. At the request of the Algerian Government authorities, the company engaged, in conjunction with various owners of hydro-electric concessions, in working out a scheme for the progressive utilisation of the water-power resources of the country.

Ashton-under-Lyne.—SUB-STATION.—The Town Council proposes to erect a sub-station on the Technical College site.

Bedford.—EXTENSIONS.—At a cost of £1,800 the Electricity Committee is to extend mains to Ampthill to supply 33 houses, and improve the supply to Willington.

WIRING LOAN.—The Committee has obtained sanction to borrow £6,000 for wiring installations.

Berwick (Northumberland).—CABLES.—Approval has been given to plans for underground cables at Marygate for the Scottish Southern Electric Supply Co., Ltd.

Bolton.—SUB-STATION.—The Electricity Committee is to provide a transformer sub-station for the Haulgh district.

Bournemouth.—HOSPITAL SUPPLY.—The borough engineer is preparing a report for the Health Committee with regard to the comparative cost of obtaining electricity for the hospital by generating privately and taking energy from the Bournemouth and Poole Electricity Supply Co.

Bromsgrove.—SUPPLY TO FRANKLEY.—The S.W. and S. Electric Power Co. proposes to afford a supply of electricity to Frankley.

Bury.—LOANS.—The Corporation is applying for borrowing powers for £25,000 for apparatus in connection with the hire and hire-purchase schemes, wiring, &c.

Buxton.—SUB-STATION.—The Town Council proposes to erect a sub-station on a site at the rear of Peak Buildings.

Cambridgeshire.—RURAL SUPPLIES.—This year's programme of the Beds, Cambs and Hunts Electricity Co. includes the extension of supplies to the villages of Wicken, Hardwick, Barrington, Orwell and possibly Teversham. The company has had to abandon a scheme to Fulbourn because of the restriction on overhead lines.

Cheltenham. — RURAL EXTENSIONS. — Sanction has been received by the Electricity Committee to the erection of overhead lines for the proposed extension of the mains at Prestbury, and a site has been obtained in Moorend Road for the erection of a sub-station in connection with the scheme for extending the mains in Charlton Kings and Leckhampton.

FRINGE ORDER.—The Committee is to seek a Fringe Order to supply Dixton Manor and other houses in the neighbourhood.

Chester.—OVERHEAD LINES.—Application is being made for permission to borrow £8,540 for additional lines from Waverton to Brassey Green to improve the supply in the Tarporley district, including low-voltage supplies to Hargrave, Green Looms, Burton and Stapleford.

Darlington.—NEW EQUIPMENT.—Application is to be made by the Town Council for sanction to borrow £500 for cables and screens required for switches and reactors at the electricity works.

Dorchester.—CABLE DUPLICATION.—In order to maintain an adequate service following the increasing demand in residential areas, the Electricity Committee is to duplicate cables, &c., at an estimated cost of £810.

Earby.—ROAD LIGHTING SCHEME REJECTED.—Although it was reported that Barnoldswick Council was considering the provision of lighting along the section of the Barnoldswick—Kelbrook county road within its area, the Earby Council at its recent meeting rejected a proposal to illuminate its own portion of the road.

Exeter.—HIGH-VOLTAGE EQUIPMENT.—Tenders are shortly to be invited by the Electricity Committee for a 33,000-V bulk supply feeder, a 6,000-kVA transformer for the Exe Valley Electricity Co., and a 6,600-V cable.

Finchley.—BETTER LIGHTING.—The Electricity Committee is to improve the lighting in the Great North Road and the High Road at a cost of £4,800.

LOANS.—Permission has been obtained to borrow £6,635 for the construction of a switch house, £6,000 for wiring and £24,000 for apparatus.

Fleetwood. — ELECTRICITY CHARGES. — By a single-vote majority the Town Council has agreed to an increase of electricity charges to consumers using under 40,000 kWh a year by 2½ per cent., instead of 5 per cent. as recommended by the Electricity Committeee.

Foxton.—CABLES.—No objection is being made by the South Cambridgeshire Rural District Council to the request of the Beds, Cambs, and Hunts Electricity Co. for sanction to the erection of overhead lines and underground cables in the parish of Foxton.

France.—PROGRESS IN PARIS.—In its report for last year, the Société d'Electricité de la Seine announces that the sales of power during the twelve months amounted to 330 million kWh, an increase of about 13.6 per cent. over 1936. The advance is stated to have been chiefly due to the demand for power for the 1937 International Exhibition in Paris, to the running of electric trains on the State railway between Paris and Le Mans, and to the increasing demands of the Paris Metro.

DEVELOPMENT IN THE NORTHERN REGION.—The Compagnie Centrale d'Energie Electrique, which supplies an important area in the Seine Inférieure department, reports substantial progress. During the past year sales amounted to 160 million kWh, an increase of 10 million kWh. This energy was produced locally, mainly in the Grand Quevilly plant, the output of which rose to nearly 157 million kWh. The report refers to the construction of a new 220-kV line between Rouen and Lille as an important step in its development. The completion of this line and the construction of projected lines at the same voltage to Paris and Le Mans will connect the company's network with the general high-voltage grid.

Guildford.—INCREASING ELECTRICAL DEVELOPMENT.—The electrical engineer has reported to the Electricity Committee that, owing to the heavy increase in the demand in the Stoughton district, it will be necessary to make provision for the greater load which will be experienced during the coming winter. He, therefore, proposes to lay a cable and erect a large new sub-station to contain a 500-kVA transformer, together with the usual switchgear. A transformer of 300-kVA capacity housed in the usual kiosk will also be erected in the Grange Road area. The scheme does not include the replacement or renewal of any existing mains or plant, as it is entirely new work, the total estimated cost of which is £5,450.

Hull.—BETTER THAN EXPECTED.—Reporting the connection of 7,606 new consumers during the year ended March 31st as compared with 7,335 in the previous year, Mr. J. N. Waite, the city electrical engineer and general manager, states that he has anticipated for a year or two that the number of new consumers would start to decrease, but it has been well maintained. During the year 310 million kWh was generated, against 279 million kWh in the previous year, the undertaking itself requiring 259 million kWh as compared with 238 million kWh in 1936-37. The average amount of coal consumed per kWh generated fell from 1,469 lb. to 1,429 lb., but the cost of coal rose from 0.1067d. to 0.1220d. For the year the average price of coal consumed by the Department was 15.11d. as compared with 13s. 6d. in the previous year, and for March it was 19s. Within a month or two the full effect of the higher prices will be felt, old contracts having practically expired.

Indo-China.—SITUATION STATIONARY.—The reports of the Eaux & Electricité d'Indochine and of the Indochinoise d'Electricité companies, controlling the principal part of electrical distribution in that country, show little improvement during the past year. Only the profits of the two companies have been made public, but for both companies these show a slight increase. This would seem to indicate that development has been progressing rather slowly during the past year.

Jarrow-on-Tyne.—ELECTRIC STREET LIGHTING.—The Ministry of Health has sanctioned the borrowing of £1,400 by the Town Council for the provision of electric lighting in York Avenue.

London.—BERMONDSEY.—The Electricity Committee is to borrow £3,000, which it is proposed to contribute towards the cost of a 6,000-kVA transformer to be provided by the London Electric Supply Corporation at the Neckinger sub-station. Sanction is being sought to loans of £20,000 for cookers, £2,500 for washboilers, and £2,500 for water heaters.

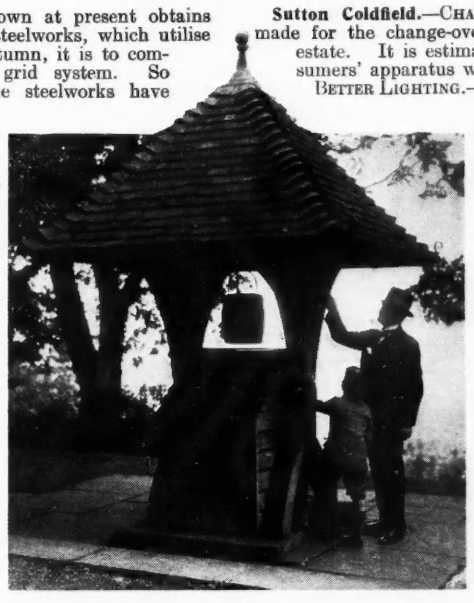
HAMMERSMITH.—Better street lighting is to be provided at a cost of £14,154. The Highways Committee reports that the London Passenger Transport Board has inquired whether the Council is prepared to bear the cost of electricity required to light bus shelters. The Metropolitan Boroughs Standing Joint Committee is being requested to consider the matter with the object of recommending a common policy to the constituent Councils.

LAMBETH.—The Council has decided to light the footpaths in Norwood Park with 100-W lamps at an initial cost of £550 and an annual maintenance charge of £66.

ST. MARYLEBONE.—The Electricity Committee is to provide rising mains at a cost of £245 at the L.C.C. housing estate in Richmond Street. Sanction is being sought by the Electricity Committee to borrow £84,520, representing the value of motors, cookers, heaters, &c., for hire to consumers, purchased up to March 31st, 1937, and £100,000 for the purchase, as and from April 1st, 1938, of similar appliances.

Lowestoft.—CHANGE-OVER.—At a recent Council meeting the action of the Electricity Committee in accepting tenders at £6,066 in connection with the change-over of the system to a.c. was approved. It was also reported that sanction had been obtained to a loan of £24,250 for the change-over.

Scunthorpe.—BULK SUPPLY.—The town at present obtains its electricity from two of the local steelworks, which utilise waste gases for generation. Next autumn, it is to commence taking its supply from the grid system. So rapid has been development that the steelworks have been barely able to cope with the demand for electricity, especially as they themselves are in need of increasing supplies. When the change has been completed the Appleby Frodingham Steel Co. will take part of the town supply. A new transformer station is to be erected at an estimated cost of £80,000.



An automatic electric pump has recently been installed in this historic well at Toys Hill, near Sevenoaks

Sedgley.—PETITION FOR ELECTRIC LIGHTING.—A deputation appointed at a meeting of 200 tenants was received at a recent meeting of the Urban District Council. Its spokesmen urged the Council to provide electric lighting in place of gas in all Council houses. The Council referred the matter to the Housing Committee for reconsideration.

Spenborough.—UNDERTAKING AND THE RATES.—We regret that in our last issue the amount by which the electricity undertaking has been assisted out of the rates was given as £81,700, instead of £8,700.

Sutton Coldfield.—CHANGE-OVER.—Arrangements have been made for the change-over of the supply on the Four Oaks estate. It is estimated that the cost of converting consumers' apparatus will be £1,775.

BETTER LIGHTING.—The lighting in Walmsley village and Eachelhurst Road is to be improved by the Highways Committee at a cost of £520.

Taunton.—EXTENSIONS.— Subject to an agreement with prospective users, the Town Council has decided to extend its electricity supply to the villages of Church Stanton and Churchinford, on the Blackdown Hills, at an estimated cost of £2,000.

Worcester.—CONTROL OF LIGHTING.—On Tuesday the Electricity Committee recommended the City Council to authorise the expenditure of £9,500 on a frequency ripple system of controlling the street lighting from a central point. The electrical engineer stated that, apart from its use in war time, such a system would effect a saving of £850 a year on present methods, and that the scheme would also be commercially justified since it was capable of being used for other purposes than street lighting. The scheme was approved.

York.—NEW EQUIPMENT.—Sanction has been obtained by the Electricity Committee to borrow £23,768 for mains, £5,345 for sub-station equipment, and £40,000 for mains and services. It is to borrow £9,000 for transformers and £2,500 for wiring.

Parliamentary News (BY OUR SPECIAL REPORTER)

Farmers and Electricity

On April 27th Sir F. Sanderson asked the Minister of Transport whether he was aware that in some parts of the country farmers were being asked to contribute sums of £800 and over towards the capital expenditure required for connecting up electrical mains to their farms, even in cases where the farms were close to main roads; and, in view of the expressed policy of the Government to encourage all branches of farming and the importance to the industry of cheap electrical power, would he state what steps he was prepared to take to ensure to farmers adequate supplies of electrical energy at economic prices and to prevent these demands for capital contributions being made.

Mr. Burgin said that the question of the further extension of supplies in rural areas was being carefully considered in connection with the Government proposals for the reorganisation of distribution, but if in the meantime his hon. friend would furnish him with information as to any particular cases he might have in mind he (the Minister) would be pleased to arrange for the circumstances to be investigated. He was not prepared to agree that in no case should capital contributions be required.

Utility Companies and the A.R.P.

On April 28th Mr. R. Morrison asked the Home Secretary whether he could make any further statement with regard to air-raid expenditure by public utility companies; whether legislation would be necessary; and, if so, when it would be introduced.

Mr. G. Lloyd said that the basis of the proposals for financial assistance to public utilities had been discussed with the Technical Committee of the Electricity Industry and with the Gas Council, and arrangements were being made for discussion with representatives of the other public utility services. Legislation would be necessary for the purposes of the expenditure, but the Home Secretary could not say at the moment when it would be introduced. It would, however, not be necessary for the public utility services to wait until the legislation was passed before beginning on their schemes of protection.

American Control of Capital

On May 2nd Mr. De la Bere asked the Minister of Transport whether his attention had been drawn to the large amount of capital in electricity undertakings throughout the country controlled by American interests; and whether he would consider introducing further legislation to prevent this.

Captain A. Hudson said he presumed his hon. friend was referring to electricity supply undertakings in Great Britain. He was not aware that any large amount of capital in these concerns was now controlled by American interests. The second part of the question did not, therefore, arise.

Duty on Electricity in Bengal

Mr. Cary asked the Under Secretary of State for India whether his attention had been called to the doubts raised as to the validity under the new Government of India Act of the duty on the consumption of electricity now in force in Bengal; and whether he proposed to take any steps to prevent this important source of revenue ceasing to be available to the provincial government.

Lord Stanley replied in the affirmative. He said that the possibility that this duty might cease to be one within the competence of the provincial legislature to impose was an unforeseen result of the Act of 1935, which the Secretary intended to take an early opportunity to seek the authority of Parliament to correct, with effect retrospective to the commencement of the Act.

London Transport and the Grid

A Select Committee of the House of Commons, presided over by Mr. G. W. Rickards, considered on May 3rd the London Passenger Transport Board Bill, among the provisions of which is a clause enabling the Board to link up with the grid. This clause was opposed by electricity companies operating in the County of London.

Mr. Craig Henderson, K.C., for the promoters, said the clause which was objected to provided that the L.P.T.B. and the Central Electricity Board might, with the consent of the Electricity Commissioners, enter into agreements for the supply of electricity by the Central Board to the Transport Board in time of emergency or failure and by the Transport Board to the Central Board at any time and at such prices and on such terms and conditions as might be agreed between them. Plans had been made for an entire reconstruction of the Transport Board's station at Greenwich and ultimately it would have a capacity of 112,000 kW. The permanent load was estimated at only 84,000 kW, but it was necessary to have a certain margin of plant which could be operated with advantage if the energy generated could be supplied to the Central Board.

It was proposed that the supply from the grid should be given through the Transport Board's sub-station at Aldgate. The Central Board would be involved in a cost of £100,000 and as the supply taken would only be in case of emergency, it was obvious that the standing charges on that sum would not be met. The supply by the Transport Board to the grid would be made in a way that would meet those charges. The electricity supply companies did not object to the Transport Board giving a supply to the grid but they did oppose the taking by the Transport Board of a supply from the grid. He would point out, however, that it was only an emergency supply and would not be a supply competing with any of the companies.

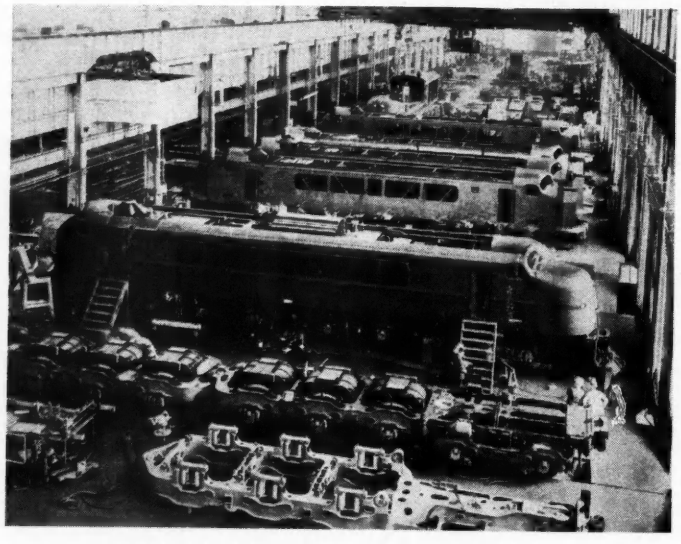
Mr. Frank Pick, vice-chairman of the Transport Board, giving evidence in support of the proposal, said the primary reason for it was the possibility of war damage, but it was thought that when taking powers to deal with a major emergency it would be well also to take powers to deal with the minor emergency of a breakdown.

Mr. S. Turner, K.C., for the electricity supply companies, asked the Committee if it passed the clause to make it operative only in case of national emergency, and then only if the appropriate authorised undertaker was unable forthwith to give an emergency supply.

After the Committee had discussed the matter in private the Chairman asked the parties to get together and try to formulate an agreed clause.

Communications

France.—RADIO CONTROL OF SEA FOG SIGNALS.—In a recent issue of the *Bulletin* of the Société Francaise Radioelectrique some particulars are given of the experiments conducted for the French Lighthouse Buoys and Beacon Service in the remote control by radio of sea fog signals known as fog gas cannons. The tests were made on a wavelength of 90 cm. by means of a special duo-diode and two "Magnetron" valves from the tower at the maritime station at Cherbourg and a gas-lighted buoy off Querqueville, a distance of about 3½ miles, and are stated to have proved very successful.



Great Britain.—RADIO RELAYS.—The Telecommunications Department of the G.P.O. has denied reports to the effect that the G.P.O. is considering introducing a radio relay service at Brighton.

Revised technical conditions relative to the operation of radio relay exchanges have been drawn up by the G.P.O. and have been circulated to each relay operator. The new conditions contain several amendments and clarifications of the previous conditions.

POST OFFICE REGIONAL SCHEME.—At a luncheon following the laying of the foundation stone of new Post Office regional headquarters at Leeds last week the P.M.G. (Major Tryon) referred to the scheme of regional control. He said that the experiment of 1936, when two regions were set up, one covering all Scotland, with headquarters in Edinburgh, and the North-Eastern Region, with headquarters in Leeds, had been so successful that he had now decided to make these two experimental regions and the London Postal and Telecommunications Regions permanent and extend the benefits of regionalisation throughout the country by the creation of another six regions. The new regions would be: Midland, North-Western, South-Western, Home Counties, Welsh and Border Counties and Northern Ireland. Each would be divided into a number of telephone areas.

Sweden.—AUTOMATIC TELEPHONY.—In the presence of the Swedish Minister of Transport a large new automatic telephone exchange was recently inaugurated in Stockholm. Through the putting into service of this exchange practically the whole telephone system of the Swedish capital has been made automatic. The system comprises at present about 136,000 subscribers.

Traction

Gateshead.—TRAMWAY BILL PETITION.—A petition against the Gateshead and District Tramways and Trolley Vehicles Bill has been lodged in the House of Commons by the Gateshead Corporation. The Bill was passed recently by a Select Committee of the House of Lords.

Germany.—ELECTRIFIED SYSTEM.—At the end of 1937 the electrified sections of the German State Railway totalled 2,288 km. (1,421 miles), states the *Railway Gazette*. The suburban lines in Berlin are low-voltage, d.c., and the remainder of the electrification is single-phase. The yearly energy consumption is 860 million kWh. These figures are equivalent to 250,000 kWh per km. of main line a year and 1,230,000 kWh per km. of suburban line. The specific energy consumption measured at the vehicle current collector averages 23.5 Wh per tonne-km. on the main lines and 50.1 Wh per tonne-km. for suburban trains. Measured at the h.v. bus-bars the respective consumptions are 2 and 57.1 Wh. The electrified system is worked by 543 electric locomotives, 1,123 motor coaches, and 1,319 trailers and driving trailers.

New electric locomotives for the New Haven Railroad, U.S.A.

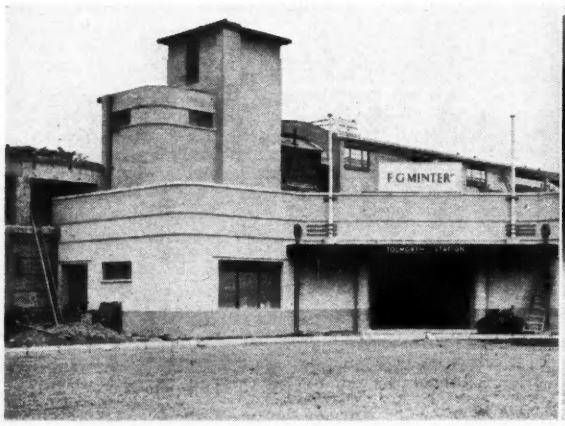
London.—IMPROVEMENTS AT ELEPHANT AND CASTLE.—An extensive improvement scheme at the Elephant and Castle tube station costing about £150,000 is being undertaken. To accommodate larger trains the platforms are to be lengthened from 280 ft. to 377 ft. and two new 515 ft. sidings are to be provided.

Newcastle-on-Tyne.—ELECTRIC TRAINS.—A full service of electric passenger trains was brought into use on the L.N.E.R. Newcastle-South Shields route on Monday. Electric trains were first introduced on March 14th, and since then the number has been gradually increased and the steam passenger trains gradually withdrawn. The electric trains operate a 20-min. service and cover the distance between South Shields and Newcastle in 27 min. against the 34 min. taken by the steam trains.

VISITORS FROM NORWAY.—When a deputation of members of the Bergen Municipal Tramways Board visited Newcastle last week to inspect the trolley-bus system the Burgomaster told a *Newcastle Journal* reporter that for a number of years they had been considering changing from trams to trolley-buses in Bergen, and, as there were no modern trolley-buses in Norway, they had come to see those in England.

Switzerland.—TROLLEY-BUSES REPLACE TRAMS.—The excellent results achieved by the two trolley-buses which have been in use for some time between Lausanne and Ouchy have led the Lausanne tramway authorities to decide on the replacement of a part of the tramway system by trolley-buses. The total length of the lines to be dealt with is about 10½ miles, over which 40 per cent of the total traffic is run. This development calls for thirty-three new buses each designed to carry twenty-two passengers at a normal speed of 10 m.p.h.

United States.—STREAMLINED ELECTRIC LOCOMOTIVES.—The above photograph shows a number of streamlined electric locomotives for the New Haven Railroad under construction in the shops of the General Electric Co. at Erie, Pa. Rated at 3,600 h.p. these locomotives will be able to haul 15-car passenger trains between New York and New Haven at a speed of more than 80 miles an hour. They will operate either from the third rail, as used at the Grand Central and Pennsylvania stations in New York, or from overhead wires, as used by the New Haven on its electrified section. The locomotive in the foreground was delivered to the railway company a week or two ago.



[*Elec. Rev.* photos.

One of the stations on a new electric line which is being constructed by the Southern Railway from Motspur Park to Chessington Grange at a cost of £440,000. The first two stations, Malden Manor and Tolworth, will be opened on May 29th

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Abertillery.—May 16th. Electricity Department. Materials for twelve months. (April 29th.)

Australia.—MELBOURNE.—May 16th. City Council. Metal-clad switchgear for city sub-stations. (T.Y. 20797/38.)*
June 15th. Victorian Railway Commissioners. 250-V copper conductors. (T. 21258/38.)*

Barnoldswick.—May 14th. Electricity Department. Material and equipment for use on a 6.6-kV system. (April 29th.)

Bath.—May 10th. Electric lighting installation in 564 houses. City engineer, Guildhall.

Belfast.—May 20th. Electricity Department. Loud speaking telephone equipment for Harbour power station. (See this issue.)

Birmingham.—May 7th. Education Committee. Electrical sundries for twelve months. Chief education officer, Council House, Margaret Street.
June 15th. General Purposes Committee. Complete electrical installation in a block of municipal offices now in course of erection. (April 29th.)
May 18th. Electric Supply Department. Cable jointing compound for twelve months. (See this issue.)
May 23rd. Public Assistance Committee. Electric lighting and power, electric bed lift, fire alarms and bells and heating installations for Highbury Home, Moseley. (See this issue.)

Bingley.—May 31st. Electricity Department. Two 500-kW mercury-arc traction rectifiers with transformers, switchgear, &c. (See this issue.)

Bradford.—May 18th. Corporation. Fire extinguishing installations for five 33-kV switch houses. (See this issue.)

Burnley.—May 16th. Electricity Department. Four 750-kVA transformers. (April 29th.)

Cheadle and Gatley.—May 16th. Electricity Department. One 250-kVA transformer. (April 29th.)

Chesterfield.—May 12th. Electricity Department. Cable. (April 29th.)

Croydon.—May 17th. Electricity Department. Stores and materials for twelve months. (April 29th.)

Dagenham.—May 20th. U.D.C. Electrical installations in 160 houses on the Mill Park housing estate, Chadwell Heath. (See this issue.)

Epsom.—May 16th. Electricity Department. P.i., lead-covered and double steel armoured l.v. cable. (April 29th.)

Fife.—May 7th. Works Department. Materials, including cables, conduits, flexes, lamps, shades and accessories, for twelve months. Medical superintendent, District Asylum, Cupar.

Glasgow.—May 9th. Electricity Department. Materials for twelve months. (April 22nd.)

Gloucester.—Electricity Department. One 300-kVA and six 700-kVA transformers. (See this issue.)

Halifax.—May 14th. Electricity Department. Fire extinguishing equipment for Highroad Well sub-station. (April 29th.)

Hastings.—May 30th. Electricity Department. Boiler fuel for mechanical stokers at Broomgrove sub-station. (See this issue.)

Hitchin.—May 11th. Electricity Department. One 1,500-kVA and three 250-kVA transformers. (April 29th.)

Hoylake.—May 31st. Water Department. One 100-kW Diesel engine generator. Clerk of the Council.

India.—SIMLA.—May 19th. Indian Stores Department. Five-core flexible cable for inter-vehicle electric couplers. (T. 21267/38.)*

Irvine (AYRSHIRE).—May 9th. Town Council. Electric lighting for 126 houses at Springbank. Town Clerk (deposit £1 1s.).

Lanark.—The County Council invites applications from electrical contractors to be placed on its list for the issue of schedules in connection with electric street lighting installations. (See this issue.)

Lancashire.—May 20th. County Council. Electric lighting installation at the new senior Council school at Maghull, nr. Ormskirk. Clerk of the County Council, County Offices, Preston (deposit £2).

Leigh (LANCS).—May 16th. Transport Department. One 10,000-gal. storage tank complete with electric pump and motor, piping and gravity feed meter, and one electrically driven band saw, complete with motor. Town Clerk, Town Hall.

London.—STEPNEY.—May 16th. Electricity Supply Undertaking. House service meters, demand indicators, conduits, troughs and covers and electric lamps for twelve months. (April 22nd.)

Manchester.—May 9th. Electricity Department. Three mercury arc rectifier equipments. (April 22nd.)

Middlesex.—May 16th. County Council. Electrical installation in connection with extensions to the Stationers' Company School, Hornsey. (April 22nd.)
June 3rd. Electrical installation at the West Middlesex County Hospital extension, Isleworth. (April 29th.)

New Zealand.—WELLINGTON.—June 9th. Posts and Telegraph Department. 6,600 ft. of telephone cable. (T.Y. 20903/38.)*
May 31st. One d.c. motor generator set complete with accessories and spares. (T.Y. 20758/38.)*
July 26th. Public Works Department. Nine oil circuit breakers complete with accessories for Section 453 of the Mangahao scheme. (T. 21120/38.)*
August 9th. One complete set of 110-kW steelwork, switchgear and accessories for use at the Waitaki sub-station. (T. 21119/38.)*
AUCKLAND.—May 23rd. Electric Power Board. 42,000 l.v. porcelain insulators. (T. 20907/38.)*

Peeblesshire.—May 7th. Education Committee. Heating and electrical installations at new central school at West Linton. Reid and Forbes, 17, Great Stuart Street, Edinburgh.

Perth.—May 14th. Corporation. Electric lighting of 214 houses at Muirton. Town Clerk (deposit £1).

Portsmouth.—May 20th. City Council. Switchgear and wiring of plant at the Victoria Park Baths. (See this issue.)

Risca (Mon).—May 17th. Electricity Department. Stores and materials for the period ending March 31st, 1939, and sub station electrical equipment. (See this issue.)

Seaham.—U.D.C. Electric lighting installation in twenty-four houses in Dawdon Crescent and 204 houses on the West Park estate. Electrical engineer, Blandford Place.

Sheffield.—May 10th. Electricity Department. Distribution transformers. (April 22nd.)
May 6th. Transport Department. Materials, including traction lamps, cables, armature coils and commutators. Town Clerk, Town Hall.

Sleaford.—May 23rd. Joint Visiting Committee. Electrical installations at Rauceby Mental Hospital. (See this issue.)

South Africa.—JOHANNESBURG.—May 21st. City Council. Twenty-two h.v. circuit-breakers complete with accessories. (T.Y. 20940/38.)*
May 26th. Union Tender and Supplies Board. Secondary cell batteries. (T. 20683/38.)*
PORT ELIZABETH.—May 12th. City Electrical Engineer's Department. E.h.v. and l.v. cables. (T.Y. 20813/38.)*
Meter-testing equipment and portable instruments. (T.Y. 20730/38.)*

Wallasey.—May 17th. Borough Council. H.v. and l.v., p.i. cables. (See this issue.)

Walton and Weybridge.—May 18th. Electricity Department. One e.h.v. 11,000-V feeder cable and two 300-kVA three-phase transformers. (April 29th.)

West Ham.—June 17th. Electricity Department. One 200-kW electric generator and one five-panel switchboard. (April 29th.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barking.—Electricity Committee. Accepted. Switchgear for Invicta Foil Co.'s sub-station (£184).—Switchgear & Cowans. H.v. cable (£2,407) and pilot cable (£436).—St. Helen's Cable & Rubber Co. H.v. switchgear (£2,250).—Crompton Parkinson. Cable cover tiles (£131).—H. J. Baldwin & Co.

Bedford.—Electricity Committee. Recommended. Transformer kiosk (£486).—Yorkshire Switchgear Co.

Birmingham.—Electricity Committee. Accepted. Electrical installations: Council school, Quinton (£1,714).—W. S. Vaughton. Clinic, Northfield (£336).—H. Pratt. Peckham Road (Kingstanding) Council school extensions (£263).—Parker, Winder and Achurch. Clinic, Perry Barr (£220).—H. Pratt.
Accepted during the period December 10th to March 18th. Automatic split pilot protective gear at various sub-stations.—A. Reyrolle & Co. Meters.—Chamberlain & Hookham; Switchgear & Meters; Measurement; Landis & Gyr; Aron Electricity Meter; British Sangamo Co. Storage water heaters for twelve months.—Berry's Electric. Electric cookers and a supplemental contract for small electric cookers for twelve months.—G.E.C. Control panels for electric water circulators for twelve months.—Simplex Electric Co. Electric water circulators and flanges for twelve months.—Hotpoint Electric Appliance Co. Conversion of electricity prepayment meters.—Chamberlain & Hookham.

Blackburn.—Electricity Committee. Recommended. Polyphase meter-testing set.—Ferranti, Ltd.

Cheltenham.—Town Improvement Committee. Accepted. Electric ovens for Town Hall catering department (£110).—Revo Electric Co.

Darlington.—Town Council. Accepted. Transformer.—Yorkshire Electric Transformer Co.

Dundee.—Town Council. Accepted. Electric lighting and clock installation at Stobswell Central School extension (£2,041).—D. J. Macdonald.

Exeter.—Electricity Committee. Accepted. One 800-A (£970) and one 600-A circuit-breaker (£676) and bus section unit (£475).—Ferguson, Pailin.

Glasgow.—Transport Committee. Accepted. Cables.—Britannic Electric Cable Co.; Craigpark Electric Cable Co. Copper bonds.—B.I. Cables.
Health Committee. Accepted. Electrical installation at Brackenhirst Farm (£578).—Kennedy, Stark & Co.

Guildford.—Housing Committee. Accepted. Electrical installations at 146 houses at Westborough (£1,388).—G. Duder Gray.

Hull.—Electricity Committee. Accepted. Cables for twelve months.—Crompton Parkinson. C.t.s. and v.i.r. cables for twelve months.—Mersey Cable Works. Cables for the period prior to July 1st, 1938 (not exceeding £15,000).—Ismay Cables.

London.—L.C.C.—Wiring and fittings for electric lighting, &c., in dwellings in the Dock Cottages area, Poplar:

	£		£
Buchanan and Curwen. Accepted	**994**	Houchin	1,134
Archibald Meckhonik	1,095	F. G. Edey and Co.	1,150
Grant and Blake	1,124	City Electrical Co.	1,171
		A. Gordemer and Son	1,814

Wiring and fittings for electric lighting, &c., in dwellings at Haggerston estate, Shoreditch:

	£		£
Holliday and Son (Electrical). Accepted	**1,370**	Houchin	1,704
C. J. Ferguson and Sons	1,460	Rylands Electrical Co.	1,779
Buchanan and Curwen	1,464	E. C. Champion	1,886
Newman and Watson	1,608	Keeble	1,909
J. L. Shadwell	1,629	Electrical Installations	1,942

Electrical installations in connection with adaptation of Leytonstone House as annexe to Darenth Park:

	£		£
Holliday and Son (Electrical). Accepted	**2,761**	Electrical Installations	3,070
Samuel Reed and Sons	2,898	Pinching and Walton	3,092
Ilford Electrical Co.	2,945	Malcolm and Allan (London)	3,241
Archibald Meckhonik	2,955	L. G. Tate and Co.	3,300
W. J. Furse and Co. (London)	2,960	W. H. Gaze and Sons	3,305
G. E. Taylor and Co.	3,045	H. J. Cash and Co.	3,319
		Evans and Shea	3,545

Provision and erection of an electric bed lift in the new ward block at Mile End Hospital:

	(Commutator motor). £	(Alternative type). £		(Commutator motor). £	(Alternative type). £
Marryat and Scott. Accepted	**1,191**	**1,161**	Pickerings	1,290	1,165
Evans Lifts	1,220	—	Waygood-Otis	—	1,330
Express Lift Co.	1,240	1,260	J. and E. Hall	1,470	1,381

ST. MARYLEBONE.—Electricity Committee. Accepted. Cable laying (£10,761).—Constable Hart & Co.

Middlesex.—Health Committee. Recommended. Electrical work at White Webbs Institution (£727).—Read and Partners. Accepted. Electrical work at Chase Farm mortuary (£75).—Colston Electrical Co.

Electrical installation at Enfield casual wards:

	£		£
Thorpe and Thorpe. Recommended	**919**	Ilford Electrical Co.	1,156
Colston Electrical Co.	975	G. A. Weston	1,157
Read and Partners	1,027	Davis Myer and Co.	1,163
Electrical Installations	1,036	F. Troy and Co.	1,181
Holliday, Hall and Stinson	1,052	W. B. and H. C. Cables	1,298
C. J. Berry	1,075	G. E. Wallis and Sons	1,351
Burdette and Co.	1,104	Marryat and Place	1,352
Houchin	1,138	Knight and Hitchcox	1,427

Newark-on-Trent.—Electricity Committee. Accepted. Cable for mains extensions during the year (£1,701).—B.I. Cables. Sub-standard meter (£74).—Landis & Gyr.

Northamptonshire.—Public Assistance Committee. Accepted. Installation of electric wiring in the maternity block of the Kettering Institution (£186).—Hutchings & Cunnington.

Salford.—Electricity Committee. Recommended. Supplying and laying 33-kV feeder cable from Frederick Street to Trafford sub-station (£5,222).—W. T. Glover & Co.

Staffordshire.—Education Committee. Accepted. Installation of electric lighting and power in schools in course of erection: Senior mixed, Codsall (£526).—France's Electric. Junior mixed and infants, Stafford (£227).—W. Hampton. Senior boys, Uttoxeter (£626).—E. M. Evans & Sons. Tamworth senior girls' gymnasium (£89).—France's Electric.

Stourbridge.—Town Council. Accepted. Electrical installations in 122 houses at Hungary Hill (£539).—Gwilliam Bros.

Whitby.—R.D.C. Accepted. Electrical installation in Council houses at Staithes (£153).—M. Theaker.

Wimbledon.—Electricity Committee. Accepted. Cables.—Britannic Electric Cable & Construction Co.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, May 12th. Institution, London, W.C.2. 6 p.m. Annual general meeting. 6.30 p.m. Faraday Lecture on "The Evolution of Electrical Power." Dr. A. P. M. Fleming.

Meter and Instrument Section.—Saturday, May 7th. Summer visit to Manchester and district.

Transmission Section.—Wednesday, May 11th. Institution, London, W.C.2. 6 p.m. "Centralised Control of Public Lighting and Off-Peak Loads by Superimposed Ripples." Mr. H. Purslove Barker.

Friday, May 13th to Tuesday, May 17th. Week-end visit to Belgium.

Scottish Centre.—Friday, May 6th. Training College Hall, Park Place, Dundee. 7.30 p.m. The Faraday Lecture. Dr. A. P. M. Fleming. Saturday, May 7th. Excursion from Dundee to Taymouth Castle Hotel.

Hampshire Sub-Centre.—Wednesday, May 11th. University College, Southampton. 7.30 p.m. "Safeguards against Interruptions of Supply." Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn.

Birmingham Electric Club.—Friday, May 6th. Summer visit to the G.E.C. Lamp Works, Wembley.

Institution of Post Office Electrical Engineers.—Tuesday, May 10th. 5.30 p.m. Institution of Electrical Engineers, Savoy Place, London, W.C.2. "Public Address Facilities on Radio and Telephone Circuits." Messrs. G. T. Evans and E. J. Casterton.

Illuminating Engineering Society.—Tuesday, May 10th. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1. 6.30 for 7 p.m. Annual general meeting. "Progress in Illuminating Engineering Abroad." Mr. E. Uytborck.

Notes

I.E.E. Arrangements

The Institution of Electrical Engineers has sent us a list of functions which are being held during the next few months and from this we note that the conversazione to overseas members is to be held on June 16th and the annual conversazione on June 30th. The following are the dates of summer meetings:—May 28th, Wireless Section; June 17th-20th, Western Centre (Llandrindod Wells); June 22nd, Hampshire Sub-centre; July 4th-8th, Institution (Birmingham); July 30th-August 7th, London Students' Section (Germany); September 23rd-25th, Transmission Section (North Wales). The dates of annual dinners, dances, &c., have been arranged as follows:—October 28th (provisional), Mersey and N. Wales (Liverpool) Centre, Benevolent Fund dinner-dance; November 2nd, Transmission Section, conversazione and dance; November 9th, N.E. Students' Section, annual dance; November 22nd, Scottish Centre dinner; November 25th, Meter and Instrument Section dinner; December 7th, North-Eastern Centre dinner; February 9th, 1939, Institution annual dinner: February 10th, Electrical Engineers' Ball; February 24th, Hampshire Sub-centre conversazione and dance.

The opening meeting of next session will be held on October 20th, when the new President will deliver his inaugural address.

Owing to unforeseen circumstances Prof. G. Keinath, who was to have given a lecture at the meeting of the Meter and Instrument Section of the I.E.E. on May 20th on "New Measurement Technique," will not be able to be in England at that time. The following lecture will therefore be substituted: "Electrical Temperature Measurements in Physiology," by Prof. A. V. Hill.

Copies of the annual report of the I.E.E. Council for the session 1937-38 and of the accounts for the year ended December 31st, 1937, can now be obtained by members who desire them on application to the secretary, Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

The I.M.E.A. Convention

Delegates to the annual Convention of the Incorporated Municipal Electrical Association (Torquay, May 23rd-28th) have now received the official programme which contains very complete particulars of the meetings and social functions arranged for the period. It is noted that all applications for tickets for the various events must reach the Secretary by May 14th.

Lamp Specifications

The British Standards Institution has just issued a specification for tungsten filament electric lamps, and fittings, with partial daylight-colour correction (B.S.S. 793-1938), so that the light emitted is changed in colour by an amount which represents an approach to a sensation-match with daylight. It is not intended that this specification should be used for colour-matching units. A specification for this more precisely corrected fitting is in course of preparation. The new specification covers general requirements as well as the selection and conditions for test. It also includes an appendix giving an approximate test for determining the colour of the light for the purposes of the specification.

Miners' electric lamp bulbs rated at 1 A at 2 V, 1.5 A at 2.5 V, and 0.75 and 1 A at 4 V, to which B.S.S. 535 refers, had lives based on an average of 600 hours. Following further large-scale tests in selected mines and testing laboratories, the average life has been revised and is now specified as 500 hours. The result of these tests, in the form of an extensive report, has been added at the end of the specification as an appendix. Copies of these British standards may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

Radio Patent Action

The hearing was commenced in the House of Lords on Monday last of an appeal by Electric & Musical Industries, Ltd., and the Boonton Research Corporation from the judgment of the Court of Appeal reversing a judgment of Mr. Justice Luxmoore in the Chancery Division in their favour against Lissen, Ltd., and G. Kalis for alleged infringement of patent (reported in the ELECTRICAL REVIEW of August 6th, 1937). It is expected that the arguments before the Law Lords will last for several days.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

HELMAR neon clock.
NOTEX fog lamps.
ORKA blower.

Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. E. G. Simester, electrical engineer to *The Times*, has retired after thirty years' service. He is succeeded by **Mr. A. Hutchen.**

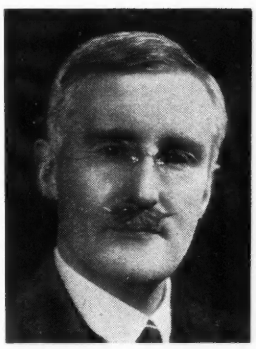
Mr. E. G. Simester

Mr. C. H. Rudd, A.M.I.E.E., A.M.I.Mech.E., has resigned his position as station engineer with the Calcutta Electric Supply Corporation, Ltd., and taken up a position as station superintendent with the Heston and Isleworth Corporation. Mr. Rudd was articled to the borough electrical engineer of Barnstaple, leaving there in 1928 to take up an appointment as assistant engineer with the Weston-super-Mare and District Electric Supply Co., Ltd. In 1930 he entered the service of the Hull Electricity Department as assistant shift engineer and subsequently acted as combustion engineer, leaving in 1933 to go to Calcutta.

Mr. E. W. Callow, assistant mains engineer with the Stepney Borough Council, has been appointed distribution engineer with the Stoke Newington electricity undertaking.

Mr. S. J. Thorpe, St. Leonards-on-Sea, has been appointed assistant mains superintendent to the Guildford Corporation.

Mr. A. Steuart, manager of the Radio and Electrical Department at Jenners, Edinburgh, was elected president of the Royal Scottish Society of Arts at a meeting of the Society held on April 25th.



[Lafayette

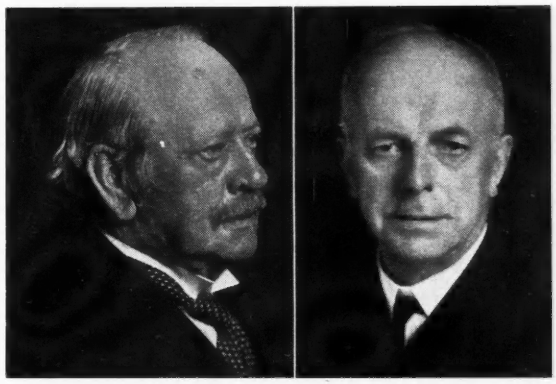
Mr. A. Steuart

Mr. F. W. Samwell, employed at the central power station of the Leicester Corporation, has been appointed air raid precautions officer at a salary of £300 per annum. He will take over his duties at once. As A.R.P. officer Mr. Samwell will be responsible for carrying out a large scheme for protecting the power station, mains, and other sections of the scattered undertakings in the City of Leicester, now in course of preparation.

Mr. W. G. Appleyard, publicity manager of the Midland Electric Manufacturing Co., Ltd., has been elected hon. secretary of the Advertising Club of Birmingham. For the past four years he has been treasurer of the Club, which he was one of the first to join on its inception eight years ago.

Mr. C. E. Berry, a director of the Southern Engineering Supplies (Pty.), Ltd., South Africa, will be visiting London and Glasgow during May and June. During his visit Mr. Berry wishes to get into touch with electrical and mechanical accessories companies who are desirous of appointing agents in South Africa. All communications should be addressed c/o Nathan & Allen, Ltd., 131, Victoria Street, London, S.W.1.

On May 3rd, the Kelvin Gold Medal for 1938 was presented to **Sir Joseph J. Thomson,** O.M., D.Sc., F.R.S., Master of Trinity College, Cambridge, in recognition of the eminent ser-



[Elliott & Fry

Sir J. J. Thomson **Mr. C. S. Franklin**

vices he has rendered to engineering science, by Lord Rayleigh, at the Institution of Civil Engineers. Mr. S. B. Donkin, president of the Institution, presented the James Alfred Ewing Medal to **Mr. C. S. Franklin** immediately before the delivery of the James Forrest Lecture by Sir Frank Smith. Mr. Franklin is well-known for his inventions and developments in connection with beam wireless.

Mr. W. M. Mahoney, for many years publicity manager to the Benjamin Electric, Ltd., has severed his connection with the company and commenced operations, in association with Mr. E. A. Mahoney, artist and designer, as publicity consultants, with headquarters at 9, Sandland Street, Bedford Row, London, W.C.1. The new organisation will trade under the name of "Mahoneys."

The Hull Electricity Committee has decided that a resolution expressing appreciation of the services of **Mr. J. N. Waite** as city electrical engineer and general manager should be engrossed on vellum and presented to him. Mr. Waite takes up his new appointment under the Central Electricity Board on July 1st.

Mr. E. C. Williams, recently with the Arc Trading Co. and formerly for many years with Britannia Batteries, Ltd., has been appointed sales manager to Attwoods (Factors), Ltd.

Obituary

Mr. H. A. Ratcliff.—We regret to learn of the death of Mr. H. A. Ratcliff, chief electrical engineer to the London Power Co. (under the engineer-in-chief Sir Leonard Pearce), at the age of sixty. Mr. Ratcliff was previously deputy chief electrical engineer with the Manchester Corporation Electricity Department, and joined the London Power Co. in 1927.

Mr. G. C. Lundberg.—We regret that by an error of a photographic agency we reproduced the portrait of the late Mr. A. P. Lundberg in reporting the death of Mr. G. C. Lundberg in our last issue.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

A. & M. Goodman, Ltd.—Private company. Registered April 23rd. Capital, £1,000. Objects: To acquire the business of a wholesaler and distributor of electric signs carried on by A. Goodman at 14-18, Holborn, E.C.3; to acquire, exploit and give effect to the rights of advertising publicity and propaganda schemes by means of cinematograph films, printed publications, displays, signs of all types, &c. The directors are: A. Goodman, 35, Wellesley Court, Maida Vale, W.; and M. Goodman, 3, Carlton Mansions, Chiehele Road, N.W.2. Registered office: 14-18, Holborn, E.C.1.

Cranbrook Radio, Ltd.—Private company. Registered April 21st. Capital, £2,000. Objects: To acquire the business carried on by Frank Davis as Cranbrook Radio in Bristol. The directors are: F. Davis (permanent governing director and chairman), Oakfield House, Wotton-under-Edge, Glos, and two others.

McBride & Nuttall, Ltd.—Private company. Registered April 21st. Capital, £1,000. Objects: To acquire the business of an electrical engineer and contractor carried on by T. H. Nuttall, trading as McBride & Nuttall at 7, Sheil Road, Liverpool, 6. The directors are: T. H. Nuttall, 35, Corbridge Road, Liverpool 16; and H. G. Oman, 151, Ince Avenue, Liverpool. Registered office: 7, Sheil Road, Liverpool, 6.

Star V. C. Co., Ltd.—Private company. Registered April 21st. Capital, £2,500. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners and other domestic appliances, &c. The permanent directors are: W. Geldard, 17, Dunkirk Road, Southport; and J. Haworth, 76, Cambridge Road, Southport. Registered office: Star Works, 13-15, Railway Street, Southport.

Birmingham Traders' Electrical Association, Ltd.—Private company. Registered April 30th. Capital, £1,000. Objects: To acquire, develop, amalgamate or carry on any trade of electric lighting, electricity generation and supply or any business relating to electrical distribution for light, heat and power, electrical and general engineering, engineering, building and contracting for supply and construction of works; to carry on the business of manufacturers of electrical and mechanical signs, advertising devices, electrical and mechanical motors, radio receivers and gramophones, &c. The permanent direc-

tors are: A. Edwards and V. Edwards, both of 6, Yateley Avenue, Perry Barr, Birmingham. Registered office: 85, Bristol Street, Birmingham, 5.

W. H. Rowe & Son, Ltd.—Private company. Registered April 29th. Capital, £5,000. Objects: To acquire the business of a manufacturing electrical and mechanical engineer carried on by W. H. Rowe at Quayside Road, Bitterne Manor, Southampton. The directors are: W. H. Rowe (permanent managing director) and Miss B. Rowe, both of Oakleigh, Lakewood Road, Chandler's Ford, Hants.

Returns of Electrical Companies

Safeguard Electrical Appliances (Dewsbury), Ltd.—Particulars filed of £2,500 debentures authorised March 14th, 1938, and covered by trust deed dated April 8th, 1938, charged on land and buildings in Dewsbury and company's undertaking and other property, present and future, including uncalled capital, the whole amount being now issued. Trustees: C. France, Five Miles, Flockton, and H. P. Ingram, Brynbella, Ilkley.

Brookhirst Switchgear, Ltd.—Capital, £550,000 in £1 shares. Return dated November 26th, 1937. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, nil.

Power Installations, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1937 (filed April 9th, 1938). All shares taken up. £1,000 paid. Mortgages and charges, £1,330.

John Collier & Co. (Electrical Engineers), Ltd.—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1. Return dated January 12th, 1938. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

General Wireless Relay Co., Ltd.—Capital, £25,000 in 20,000 preference shares of £1 and 100,000 ordinary shares of 1s. Return dated October 11th (filed December 1st), 1937. 6,007 preference and 100,000 ordinary shares taken up. £11,007 paid. Mortgages and charges, £5,300.

Greater Felcourt Co., Ltd.—Capital, £10,000 in £1 shares. Return dated December 30th, 1937. All shares taken up. £2,505 5s. paid (£1 on 7 and 5s. on 9,993 shares). Mortgages and charges, nil.

Insulators & Constructions, Ltd.—Capital, £2,000 in £1 shares. Return dated December 20th, 1937 (filed February 11th, 1938). All shares taken up. £2,000 paid. Mortgages and charges, nil.

Morris Relay Services, Ltd.—Capital, £1,000 in 1,000 shares of £1 each. Return dated December 8th, 1937. 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges, nil.

Collectron, Ltd.—Capital, £1,000 in £1 shares. Return dated December 27th, 1937. All shares taken up. £1,000 paid. Mortgages and charges, £1,725.

Electraulic Presses, Ltd.—Capital, £100 in £1 shares. Return dated January 14th, 1938. All shares taken up. £100 paid. Mortgages and charges, nil.

Eden Valley Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated April 29th, 1937 (filed February 15th, 1938). All shares taken up. £500 paid. Mortgages and charges, nil.

City Notes

W. T. Henley's Telegraph Works Co., Ltd., held its annual meeting on April 29th when Sir Montague Hughman (chairman), who presided, said that 1937 had proved to be a record year in every way in the history of the company, and all records of numbers employed had been broken. The increase in their net profits had been achieved in spite of the reduction in the rate of profit obtained, the main contributory factors to this satisfactory result being the large increase in turnover in all sections of the business both at home and overseas; a substantial advance in the return on their investments; and the fact that they had carried out the larger volume of business with a comparatively small increase in running expenses. In connection with their Gravesend works new extra-high-voltage equipment had been designed by their staff and was now being installed, and they would shortly be in a position practically to double the output of e.h.v. cables of the latest types. Considerable extensions were being made to the factory to provide for new testing plant to deal with cables of the highest voltages. The engineering department had continued to make excellent progress, and further extensions were necessary. Considerable alterations and additions had been made to the plant at the Woolwich works during the year. The equipment of the new building had been completed and this had enabled them to centralise manufacture of certain branches of their work in the factory and to produce still more efficiently. With regard to the technical side of the business, research work continued to be one of the most important branches, and during the past year they had intensified their research on basic problems affecting both rubber and paper cables. An important technical development completed during the past year by one of their engineers was a new method of testing small rubber-covered cables in the factory. The new method employed a device in which every inch of the cable was subjected to an electrical stress, which would search out defects overlooked by the older method. They had received inquiries from cable makers at home and abroad for the supply of the equipment, and had already sold a number of machines to manufacturers in this and other countries. The work done by their contract department during 1937 was in excess of that of the previous year and had shown satisfactory results. They had continued to do a considerable amount of work for the Central Electricity Board and had carried out h.v. schemes, overhead and underground, in different parts of the country. Their overseas business largely expanded during the year, and had contributed substantially to their profits. Approximately 28 per cent. of their total turnover was done overseas. This expansion was shown in almost every country. Their subsidiary, Henley's (South Africa) Telegraph Works Co., Ltd., had experienced the best trading year in its history, both turnover and profits showing new high records. In connection with the acquisition by the C.M.A. of a majority holding in a cable manufacturing company near Johannesburg, the Association had asked Henley's to carry out certain plans in connection with this company, and had expressed a desire that Mr. Bishop should go to South Africa to put these plans into effect. Their branches in India had done a greater volume of business, and their business in Australia and New Zealand showed a marked expansion. Henley's Tyre & Rubber Co., Ltd., had substantially increased its turnover, with satisfactory financial results, and the Holborn Construction Co., Ltd., reached a record figure in turnover and carried a good margin of profit. With regard to the future, orders to date had not yet reached the high figure for 1937, but they were ahead of 1936.

Mr. W. F. Bishop, in seconding the resolution for the adoption of the report and accounts, said that they had benefited by the increased activities in many industries including shipbuilding, both naval and commercial, and they were supplying a considerable part of the cable required for the *Queen Elizabeth*. For their export trade they still had to depend to a large extent on the British Dominions, and their turnover in Australia, South Africa and India represented a large proportion of the total. They were doing a considerable business outside the Dominions, but quota restrictions and exchange difficulties rendered such trade extremely difficult.

Laurence, Scott & Electromotors, Ltd., reports a net profit for 1937 of £110,680, as compared with £44,262 in the preceding year, to which is added £3,970 brought in, making £114,650. From this it is proposed to place £10,000 to investments reserve, £10,000 to general reserve, £10,000 to special depreciation reserve, £15,000 to taxation reserve, £2,000 to trustees of pension fund and £2,000 to staff deferred annuity scheme. The dividend on the "A" ordinary and ordinary shares for the year is 15 per cent., less tax (against 7 per cent.), and £6,501 is carried forward. It is proposed to increase the authorised capital to £700,000 by the addition of 100,000 5 per cent. cumulative redeemable preference shares of £1 each and 556,020 "A" ordinary shares of 5s. each and to sub-divide the existing £1 ordinary shares into four 5s. shares to be known as "B" ordinary shares. It is proposed to offer 100,000 of the above cumulative redeemable preference shares at par to all members of the company and 144,398 of the new "A" ordinary shares at 9s. 6d. each in the proportion of one new share for every ten "A" or "B" ordinary shares held. A further 15,602 "A" ordinary shares will be offered at a similar price to friends of the company at the directors' discretion. With the report and accounts a copy of the speech to be made by Mr. W. H. Scott (chairman) at the annual meeting on May 11th has been circulated. In this the chairman says that the past year had been a record one in every sphere of activity. The total output was 50 per cent. greater than the output of 1936, representing a great increase in electrical machinery for the industrial market, for export and for Government departments. The large extensions in building and plant, both at Norwich and Manchester works, were completed during the year and had been working to full capacity. At the Manchester works an entirely new layout on up-to-date lines was completed. Orders in hand had reached a record figure and were sufficient to keep the works fully employed for eighteen months, the monthly average of orders was well maintained and important contracts were in prospect. They had in operation a profit-sharing scheme in which the senior staff participated, while a prosperity sharing scheme gave to the workpeople up to a week's extra holiday pay. He was convinced that there was still enormous scope for expansion in electrification both here and abroad, and given reasonable stability he felt confident of their ability to take the fullest advantage of this expansion.

The Calcutta Electric Supply Corporation, Ltd., held its annual meeting on May 2nd, when Lord Meston (chairman), who presided, said that the report and accounts indicated a year of active progress and extending business in which the sales of electricity had improved all along the line. That there was no corresponding increase in revenue was due to the reductions in domestic and kindred charges, which had now covered all the recommendations of the recent committee of inquiry. The industrial supply had improved so much as largely to counterbalance the drop in domestic revenue. During the year there had been fresh capital expenditure of £620,000, largely spent on the new power station at Mulajore. This station would be in operation for the winter of 1939. It would then be necessary to consider the future of Cossipore, the oldest of their stations with a certain amount of obsolescent plant, in regard to which a comprehensive report by Mr. Lydall was now under the consideration of the directors. It was intended to improve the h.v. power rates in favour of the consumers, at a cost of nearly £70,000 a year; the new schedule would come into force before the end of 1938. The Government of Bengal had refused to sanction the proposal of the Calcutta Municipal Corporation to purchase that portion of the company's undertaking within the municipal boundary, and had indicated its adoption of a policy of working towards a grid system for the province and generally following the lines advocated for Great Britain in the McGowan Report. The company would readily co-operate in the policy adumbrated by the Government.

John Thompson Engineering Co., Ltd.—Presiding at the annual meeting on April 27th Mr. W. J. Thompson (chairman) said that the profits for the year constituted a record, and all subsidiary companies made profits. Mr. E. W. Thompson said that the Water Tube Co. had had a record turnover. This company dealt with large contracts both home and overseas for water-tube boilers for power stations, and it had nearing completion two 130,000-lb. boilers for Manchester Corporation Electricity Department. This was the fourth repeat order for this particular undertaking. For Coventry Corporation four large boilers of 150,000 lb. per hour evaporation each were nearing completion. The last two large boiler units for the London Power Co.'s West Deptford station were put into service in 1937. There were now six "Thompson" units in this station. During 1937 an order was received from the London

Power Co., for the same station, for a John Thompson La Mont boiler for a total evaporation of 375,000 lb. of steam per hour. This would be the largest boiler of its type in the world.

Walsall Conduits, Ltd., held its annual meeting on April 27th when Mr. A. E. Read (chairman), who presided, said that the net profits for the year under review showed an increase of nearly £38,000, and those results had been achieved despite the fact that the company had had to pay considerably higher prices for raw materials, and, except to a moderate extent, it had not been able to pass on the increased cost. The increased profits had been earned mainly owing to the additional volume of business. It was the directors' policy to keep selling prices as low as possible, believing that excessive selling prices eventually led to a curtailment of demand. Conditions had now become more normal, and trading activities generally were now on a firmer basis, with the result that he hoped they could look forward to a period of steady expansion. During the year under review they had created a record in every way, and the result for the first three months of the current year compared favourably with the corresponding period of 1937. The bulk of their business was connected with the home trade, but they did quite a substantial export trade, which also had shown a steady increase. The rearmament programme had hardly affected their business, except indirectly, but so varied was their range of specialities as practically to ensure a demand for their products in most electrical installations.

The British Thermostat Co., Ltd., held its annual meeting on May 2nd, when Col. N. Hudson (chairman), who presided, said that during the year under review they had fully maintained their turnover in spite of a somewhat disappointing refrigeration season. For the current year the prospects appeared favourable; incoming orders were good and the turnover to date covered a wide range of industries and indicated every promise of further increase. In consequence, changes in conditions in a few industries tending to reduce orders for certain of their products could be faced with relative equanimity. New development had been proceeding rapidly, and their automatic controls had been extended to a variety of new applications. These included Government searchlight switches, convector heaters, thermostats for aero engines, flat irons, permanent waving of hair, &c., covering many industrial and domestic requirements. The new factory had been partially occupied and the plant had been extended. The machine shop was now working to full capacity, and a new plating shop had been installed with a considerably increased capacity. Their export trade, both to the Colonies and foreign countries, continued to expand.

Kolster-Brandes, Ltd.—Presiding at the annual meeting on May 2nd Mr. F. Gill (chairman) said that shareholders would remember that last year, encouraged by the improvements in 1936, they decided on a more extensive advertising campaign in order to regain their lost position in the market. This had to be commenced in the early part of the year so as to reap the benefits during the peak selling period in the latter part of the year. Although sales were reasonably good up to the time of the Radio Exhibition at the end of August, soon after this there was definite evidence that the retail market had slumped and that their estimated sales were not going to be realised. Immediately this condition became evident, production was cut and expenses reduced to minimise the loss as much as possible. This falling off of retail sales also resulted in further over-production throughout the trade which increased the already existing instability on the retail side, resulting in further reductions in profits.

Following the annual meeting an extraordinary meeting was held at which resolutions were passed for the voluntary winding up of the company for reconstruction purposes and the formation of a new company with the same title; and the purchase by the International Telephone & Telegraph Corporation of the minority shareholders' holdings at 3s. 9d. per share. Mr. Gill, in submitting the proposals, said that the reason for the majority shareholders continuing in the business was that it was desirable for technical reasons that some of the companies of the International Telephone & Telegraph Corporation's system should retain a connection with the radio set business in this country, even though they did so at a financial loss, because of the link between the radio set business and their main activities in telecommunications. The intention was that this connection should be supplied by the new Kolster-Brandes, Ltd., but such a use of the company would be impossible if the interests of independent shareholders had to be considered.

The London Electric Wire Co. & Smiths, Ltd., reports a profit for 1937 of £144,410, as compared with £136,449 in the preceding year, and after charging directors' fees there is a balance of £143,393. General reserve receives £20,000 and special reserve £20,000, and it is proposed to pay a final dividend of 5½ per cent., making 7½ per cent: for the year (same). The balance carried forward is £76,634 (against £54,546 brought in). The report states that turnover still further increased during the first six months, but there was a marked decline in the latter part of the year. Meeting: May 11th.

Newman Industries, Ltd., is convening meetings to increase its capital to £195,000 by the creation of 100,000 £1 6 per cent. redeemable cumulative preference shares and 50,000 2s. ordinary shares. The preference will rank in priority to the existing 180,000 5s. preferred ordinary shares as regards dividend, and redemption to the extent of a 2 per cent. cumulative sinking fund and rights in a winding-up. Arrangements are well advanced for an issue of shares.

The Hendon Electric Supply Co., Ltd., has been approached regarding the acquisition of the ordinary shares of the company and the directors are at present in negotiation concerning the matter. If the board approves the terms, the offer will be placed before ordinary shareholders at an early date. The directors advise that holders should not deal in their shares until they hear further from them.

The Metropolitan Electric Cable & Construction Co., Ltd., reports a net profit for 1937 of £30,779, to which is added £1,265 brought in, making £32,044. After providing for income-tax and N.D.C. (£12,000) and placing £7,000 to preference share reserve and £3,000 to general reserve it is proposed to pay a dividend of 5 per cent., tax free, on the ordinary shares and to carry forward £3,331. Meeting: May 11th.

The Calcutta Tramways Co., Ltd., reports a profit for 1937, including exchange adjustment and interest and dividend income, less tax and contributions to provident and gratuity funds, and after transferring £80,000 to depreciation and £2,500 to contingency fund, of £100,774, as compared with £98,096 for the preceding year. Debenture interest absorbs £28,250, and it is proposed to pay a final ordinary dividend of 5 per cent., again making 8 per cent. for the year, leaving a balance of £20,694 to be carried forward (against £16,671 brought in).

The St. Austell and District Electric Lighting & Power Co., Ltd., reports a profit for 1937 of £14,413, as compared with £9,893 in the preceding year, to which is added £4,430 brought in, making £18,843. After placing £5,000 to reserve for depreciation it is proposed to pay a final ordinary dividend of 5 per cent., making 10 per cent., less tax, for the year (same) and to carry forward £5,994. Sales of electricity during the year amounted to over 5,000,000 kWh. and showed an increase of 37 per cent. as compared with 1936. Following the annual meeting on May 10th an extraordinary meeting will be held to consider increasing the capital to £120,300 by the creation of 10,000 new ordinary shares of £1 each, and the issue of the new shares to ordinary shareholders at 30s. each in the ratio of one for every four held. The new capital is required to meet capital expenditure and to repay bank advances.

Marconi's Wireless Telegraph Co., Ltd., reports a net profit for 1937, after providing for depreciation, of £260,300, an increase of £60,232 as compared with 1936. Contingency reserve receives £60,000 and the final ordinary dividend is 6¼ per cent., making 9 per cent., less tax, for the year (against 7 per cent.). The balance carried forward is £8,771 (against £7,783 brought in). Meeting: May 17th.

Stream-line Filters, Ltd., reports profits of £23,805 for 1937, as compared with £16,568 for the previous nine months. The final dividend is 12½ per cent., making 20 per cent. for the year (same). Tax reserve receives £2,500 and general reserve £2,000. The balance carried forward is £3,000, subject to additional remuneration to directors (against £2,286 brought in).

The Sphere Investment Trust is paying a first and final dividend of 5 per cent. for the year (same).

Tube Investments, Ltd., is increasing the interim ordinary dividend by 2½ per cent. to 10 per cent., less tax, with a relative payment on the liaison ordinary shares.

Erinoid, Ltd., has declared an interim dividend of 2 per cent. (against 3 per cent.).

Sydney S. Bird & Sons are paying an interim dividend of 5 per cent., less tax. This compares with 7½ per cent. for the first period November 18th, 1936, to September 30th, 1937.

The River Plate Electricity and Other Securities Corporation has declared a final dividend of 6 per cent., less tax, making 10 per cent., for the period.

Venner Time Switches, Ltd., is paying a final dividend of 17½ per cent. making 27½ per cent., less tax (against 15 per cent., tax free, plus a capital bonus of 80 per cent.)

The Atlas Electric & General Trust, Ltd., is paying a final dividend of 3½ per cent., less tax at 5s. 2½d., on the 7 per cent. cumulative preference shares.

S. Smith & Sons (Motor Accessories), Ltd., have declared an interim dividend of 7 per cent., actual, less tax, on the preferred ordinary shares.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets can be said to have escaped very lightly from the effects of the Budget. As it was remarked here last week, there is a good deal of adaptability in the House, just as there is in human nature. Within a few days of the Budget announcement, discussion died away and business went on as usual. Prices have suffered, on balance, hardly at all. They gave way abruptly half an hour after the Chancellor had finished his speech, the decline being recovered almost as quickly on the following day.

Gilt-edged prices remain very steady. Various good reports from companies engaged in the electrical manufacturing and equipment industry have served to maintain share values in this department. It is noticeable, however, that figures and dividends which a few years ago would have certainly caused prices to improve, now have little influence over quotations.

Gilt-edged

Twenty-four hours after the Budget, prices in the gilt-edged market gave practically no recognition of the fact that holders of the stocks will see a shrinkage of income in their next interest warrants; meagre yields on gilt-edged securities will have shrunk yet further in their net form. The market had braced itself to meet an extra burden of Government borrowing, and was consequently able to take the shock without more than a temporary recoil, even though the blow came from an unexpected quarter. This refusal of prices to give way before an event which would be expected normally to depress them can doubtless be ascribed in part to the Treasury's anxiety to keep the market in good fettle while a vast amount of borrowing awaits announcement. At the same time, there remains support from that section of the public which refuses to invest capital in more speculative markets, particularly in times of political friction such as are present to-day. The result finds reflection in the firmness of gilt-edged securities.

Transport and Traction

London Transport "C" stock has given way to 79—a fall of 10s. It is calculated that the Board's annual petrol bill will be increased, on account of the new tax, by some £125,000. Against this there is talk of the extra cost being passed on to the public by way of higher fares. Tillings, at 46s., are a few pence lower, and the drop of 25 points to 975 in British Electric Traction deferred is relatively small. West Ridings rose 1/8 to 2 1/8. On an idea that the petrol tax may work in favour of the railway systems, Home Railway stocks started a rise which was damped, however, by a disappointing set of traffic returns. In the foreign group, Brazilian Tractions have dropped to 10½. Little business is passing in Anglo-Argentine Tramway issues, but there are gains of a point each in the 4 per cent. and 4½ per cent. debentures, at 28 and 22½ respectively.

Cable and Wireless

Matters have been moving fast of late for holders of Cable and Wireless stocks, who have had to rearrange their ideas on several major points affecting their investment. First and most important was the new agreement with the Government, under which the Combine becomes free from payment of the heavy beam rental, and, at the same time, introduces a flat rate for all inter-Empire communications. To users of the system the new charges are calculated to result in an annual saving, approximately, of half a million pounds. To the company and its stockholders the result is thought to be something of a gamble on the way in which new traffic is stimulated by this encouragement. The same agreement made provision for a new standard rate of earnings by the operating concern and also for the acquisition of a block of the Combine's ordinary stock by the Government. Subsequently came a declaration of the expected 4 per cent. dividend on the latter stock, and now there is the operating company's dividend and preliminary report for 1937 to be considered. In the background is a reminder from the traffic indices that activity has so far this year been running at about 15 per cent. below last year's level. As a net result of this sequence of somewhat revolutionary events the price of Cable and Wireless ordinary stock has been left much as it was before—at a little over 60. The preference stock is 1½ higher at 103½.

Operating Results

Cable and Wireless—the operating company—forms the lowest of the three tiers which make up the group's structure. Second come the various cable and telegraph companies, which hold Cable and Wireless stock and which are controlled at the top by Cable and Wireless (Holding). Public interest is mostly concerned by the third tier. In raising this year's dividend from 2½ to 3½ per cent., the operating company announces that profits are the best recorded in its ten-year life and are greater than the new standard revenue. Assuming that these earnings filter through to the holding company in about the same proportion as before, calculations are that the latter will have a small surplus in hand after paying 4 per cent. dividend on the ordinary stock. Tempering the satisfaction with which the market heard these results is natural mystification as to how far the cut in charges will succeed in its purpose, and not a little criticism of the level at which the standard rate of revenue has been fixed.

Electrical Equipment Shares

Extra allowances for wear and tear to manufacturing companies which employ plant and machinery have sugared the income-tax pill for many sections of industry. In this lies one of the reasons for the firmness shown by industrial share-prices. At bottom, of course, the markets' strength implies confidence in the ability of industry to shoulder the burden without any material slowing-down in the rate of progress. Electrical equipment shares were among the first to regain their balance, and in one or two instances prices did more than merely make good the ground previously lost. Advances of half a crown each were secured by Callender's Cable and by Electric Constructions—the latter on hopes of an increase in the coming dividend. The rise in Ericssons was continued, the price gaining a further 1/8 to 2 1/8. General Electrics had a set-back of 2s., to 74s. 6d., at the beginning of this week, and Associated Electricals weakened from 39s. 6d. to 38s.

Miscellaneous Matters

No ill-effects from the Budget are apparent in the market for electricity supply shares, among which Edmundson's, at 37s. 6d., Electrical Distribution of Yorkshire, at 41s. 3d., and British Power and Light, at 27s. 9d., are all appreciably better. Clyde Valleys, at 35s., are now quoted ex-rights to the share offer. Babcock and Wilcox are among the more active shares in the engineering group; the price is steady at 40s., which gives a yield of exactly 5 per cent. Vickers are 23s., after being 1s. higher. Scant encouragement is forthcoming from American markets, which are despondent by reason of the state of trade and the absence of encouragement to private enterprise. With rubber again standing at less than 6d. per lb., there is a tendency towards lower prices for rubber shares. Business in most of the Stock Exchange markets is better than it was a month ago, but it can expand appreciably before reaching the point at which members of the House might complain of over-work.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. Previous.	Dividend. Last.	Price May 3.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	63/9	—	4 14 4
City of London	1	7½	7½	34/-	—	4 8 3
Clyde Valley	1	7	8	35/-xr	—	3 0 0
County of London	1	10½	10½	49/-	—	4 5 7
Edmundson's 7% Pref.	1	7	7	32/-	—	4 6 2
Do. Ord.	1	8	9	37/6	+6d.	4 16 0
Elec. Dis. Yorkshire	1	9	9	41/3	+9d.	4 7 0
Elec. Fin. and Securities	1	12½	12½	48/9	—	5 2 6
Elec. Supply Corporation	1	11	12	51/3	—	4 13 8
Lancs Light and Power	1	7½	7½	32/6	—	4 12 4
Lond. Assoc. Electric	1	—	7	30/-	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	105	—	4 15 3
Metropolitan	1	10	12	49/6	+1/-	4 17 0
Midland Counties	1	7½	8	36/-	—	4 9 0
Mid. Elec. Power	1	8	9	38/9	—	4 13 0
North Eastern Electric Ordinary	1	6	7	31/-	+6d.	4 10 4
Do. 7% Pref.	1	7	7	31/-	-6d.	4 10 4
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	46/3	—	4 6 6
Do. do. 6% Pref.	1	6	6	29/-	—	4 9 9
Scottish Power	1	8	8	36/-	—	4 9 0
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 6 0
Yorkshire Elec.	1	8	8	39/6	—	4 1 1

Public Boards.

Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	"	5	5	114	—	4 7 9
Do. 1951–73	"	4½	4½	109	—	4 2 7
Do. 1963–93	"	—	3½	99	—	3 10 8
London Elec. Trans. Gtd.	"	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	"	4½	4½	112	—	4 0 4
London Passenger Transport, A	"	—	4½	118½	—	3 16 0
Do. do. B	"	—	5	120½	—	4 3 0
Do. do. C	"	4	4½	79	-½	5 7 7
West Midlands Joint Elec. 1948–68	"	—	5	112	—	4 9 3

Telegraph and Telephone.

American Tel. & Tel.	$160	9	9	127½	—	7 1 2
Anglo-Am. Tel. Pref.	Stock	6	6	106½	-½	5 12 7
Do. Def.	"	1½	1½	26½	—	5 13 2
Cable & Wireless 5½% Pref.	"	4½	5½	103½	+1½	5 6 3
Do. Ord.	"	—	4	61	+½	6 11 3
Do. Income	"	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	14½	+½	3 15 10
Do. do. Pref.	10	6	6	18½	—	5 12 8
Great Northern Tel.	10	20	20	35½	—	4 10 7
Marconi-Marine	1	10	7½	23/9	-½	6 6 4
Oriental Telephone Ord.	1	12*	12*	2¾	—	4 7 3

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	6/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	13	—	—
British Electric Traction Def. Ord.	"	5	5	75	-25	—
Do. do. Pref. Ord.	"	8	8	160	—	5 0 0
Brazil Traction	$100	70 cts.	$1	10½	-1½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	—	5 0 6
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. 1st Bonds	$500	5	5	20	-5	—
Victoria Falls Ord.	1	20	12	3½	+⅛	3 16 10
West Riding	1	6½	10	2⅛	+⅛	4 16 10

Manufacturing Companies.

Aron Electricity Ord.	1	15	15	1⅛	—	8 0 0
Assoc. Elec. Ord.	1	10	10	38/-	-1/6	5 5 3
Do. Pref.	1	8	8	37/6	-6d.	4 5 6
Babcock & Wilcox	1	10	10	40/-	—	5 0 0
British Aluminium Ord.	1	10	12½	52/6	+6d.	4 15 2
British Insulated Ord.	Stock	20	20	4⅞	—	4 10 1
Brush Ord.	Stock	Nil	Nil	25	—	—
Callender's	1	15	15	4½	+⅛	3 6 8
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	26/3	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	35/-	+⅛	5 14 3
Enfield Cable Ord.	1	25	25	2½	—	—
English Electric	1	Nil	10	30/-	-6d.	6 13 4
Do. Do. Pref.	1	6½	6½	25/6	—	5 2 0
Ericsson Tel.	5/-	25	25	2⅛	+⅛	3 0 6
Ever Ready	5/-	45	35	23/6	-6d.	7 9 0
Ferranti Pref.	1	7	7	27/6	—	5 2 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	74/6	-2/-	4 16 7
Henley's	5/-	15	20	20/-	—	5 0 0
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 8 6
Johnson & Phillips	1	10	12½	42/-	—	5 19 1
Lancashire Dynamo	1	20	25	3½	—	8 0 0
Siemens Ord.	1	6	7½	30/-	—	5 0 0
Telegraph Construction	£1	7½	10	37/6	—	5 6 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1936

18736. "Electric systems for controlling the position of a controlled object." Sperry Gyroscope Co., Inc. July 5th, 1935. (482879.)

21182. "Electrically operated stop mechanism for automatically arresting the operations of grinding machines and other machine tools." J. Lund, Ltd., and J. D. Scaife. August 31st, 1936. (482741.)

21815. "Electric signalling systems, for instance, telephone systems." Standard Telephones & Cables, Ltd. August 31st, 1935. (482998.)

23928. "Electric communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. September 1st, 1936. (482743.)

24112. "Thermally tripped electric switches." Midland Electric Manufacturing Co., Ltd., and A. W. Vicary. September 3rd, 1936. (482822.)

26797. "Coin-actuated mechanism for electricity and similar meters." United Gas Industries, Ltd., and H. E. Angold. October 2nd, 1936. (483002.)

26804. "Fastening of metal members to casings of electrical apparatus formed of thermoplastic insulating material." Landis & Gyr Akt.-Ges. October 5th, 1935. (482945.)

26899. "Electric or like switches employing mercury or other conducting liquid." A. Cianchi. October 3rd, 1936. (482947.)

26990. "Electro-magnetically operated change-speed gear for motor vehicles." Fiat Soc. Anon. October 5th, 1935. (482827.)

27009/10. "Storage batteries." Prest-O-Lite Storage Battery Corporation. January 17th and April 20th, 1936. (482948/9.)

27041. "Television plant." G. Sylven. July 28th, 1936. (482835.)

27047. "Electric space heating system." W. Stern. October 6th, 1936. (483039.)

27146. "Control of electrical circuits by inertia switches, more particularly for the illumination of signals on vehicles." H. B. Sedgfield. October 6th, 1936. (482951.)

27271. "Oscillograph electric transient analysers." G. J. Scoles and Metropolitan-Vickers Electrical Co., Ltd. October 7th, 1936. (482956.)

27272. "Electrical impulse or peaking circuits." G. J. Scoles and Metropolitan-Vickers Electrical Co., Ltd. October 7th, 1936. (482957.)

27273. "Electro-deposition of zinc." Grasselli Chemical Co. and L. R. Westbrook. October 7th, 1936. (Cognate application 27274/36.) (482958.)

27291. "High-speed electric circuit-breakers." Whipp & Bourne, Ltd., and F. Whipp. October 8th, 1936. (482752.)

27320. "Operation of cathode-ray tubes and arrangements therefor." Radioakt.-Ges. D. S. Loewe. October 14th, 1935. (483012.)

27343. "Electron-discharge devices." Baird Television, Ltd., and P. W. Willans. October 8th, 1936. (Cognate applications 33953/36 and 5678/37.) (482959.)

27349. "Telephone instruments." J. E. Pollak. (Associated Telephone & Telegraph Co.) October 8th, 1936. (483015.)

27351. "Method of controlling the discharge current of electron valves." Telefunken Ges. für Drahtlose Telegraphie. October 8th, 1935. (483050.)

27430. "Centrifugally operated electric switches." Hoover Holding Co., Ltd. (B. L. Conley). October 9th, 1936. (483019.)

27470. "Bridges for measuring electrical impedance." Standard Telephones & Cables, Ltd., R. Webb, F. R. Rouse and F. V. Fowles. October 9th, 1936. (483023.)

27472. "Apparatus for timing X-ray exposures." Standard Telephones & Cables, Ltd., and F. N. Scaife. October 9th, 1936. (483024.)

27473. "Telephone systems." Automatic Telephone & Electric Co., Ltd., and J. W. McClew and A. H. Williams. October 9th, 1936. (483025.)

27691. "Method of eliminating arcing back and short-circuits in current rectifiers." Akt.-Ges. Brown, Boveri, & Cie. October 10th, 1935. (482962.)

28385. "Automatic reclosing switch systems." British Thomson-Houston Co., Ltd., C. J. Sarjeant and F. E. Butler. October 19th, 1936. (483056.)

28880. "Flexible electric cables." Callender's Cable & Construction Co., Ltd., and L. Hart. October 23rd, 1936. (482908.)

29001. "Thermionic valves." E. K. Cole, Ltd., and F. W. O. Kennedy. October 26th, 1936. (482909.)

29490. "Combined impedances and switch unit for supplying low-voltage circuits from higher voltage sources." A. Goodier. October 30th, 1936. (482756.)

30154. "Snap-action mechanism for operating electric switches, valves, or like devices." General Electric Co., Ltd., H. C. Turner and A. Sherwin. November 5th, 1936. 482910.)

31630. "Trunk-communication electric cables." Siemens & Halske Akt.-Ges. November 18th, 1935. (Cognate application 31631/36 and 31632/36.) (482912.)

34341. "Manufacture of flexible electric braid or cord, telephone flex and electric cables." C. Freudenberg Ges. December 21, 1935. (482974.)

1937

556. "Cores of transformers and choking coils." W. W. Triggs (Akt.-Ges. Brown Boveri & Cie.). January 7th, 1937 (convention date not granted). (482771.)

—1602. "Electric relay systems." Weston Electrical Instrument Corporation." December 7th, 1936. (482915.)

2407. "Means for controlling and indicating in circuits employing electric-discharge devices." British Thomson-Houston Co., Ltd. January 30th, 1936. (482772.)

3511. "Selectors for telephone systems." Telefonaktiebolaget L. M. Ericsson. February 5th, 1936. (482917.)

3707. "Electrical contacts for relays." Weston Electrical Instrument Corporation. December 17th, 1936. (482918.)

6076. "Electric valve circuits." British Thomson-Houston Co., Ltd. February 29th, 1936. (482982.)

9019. "Thermocouple ammeters." Weston Electrical Instrument Corporation. September 11th, 1936. (482923.)

9294. "Instruments for measuring or indicating transient abnormal electric alternating currents." E. Reich and General Electric Co., Ltd. April 2nd, 1936. (482784.)

9301. "Thermionic amplifiers." Standard Telephones & Cables, Ltd. April 1st, 1936. (482785.)

12411. "Electric cables." British Electrical & Allied Industries Research Association and S. Whitehead. April 30th, 1937. (482926.)

13295. "Arc-extinguishing tubes for electric circuit-breakers." British Thomson-Houston Co., Ltd. May 14th, 1936. (482988.)

14846. "Regulation of electric power supplied through rectifiers." Suddeutsche Apparate-Fabrik Ges. May 30th, 1936. (Cognate application 14847/37.) (482794.)

16133. "Devices comprising high-pressure metal-vapour discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 13th, 1936. (482991.)

17154. "Screen-grid thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 22nd, 1936. (482992.)

17980. "Synchronous-motor electric clocks." National Clock Manufacturing Co., Ltd., and S. Gold. June 28th, 1937. (482855.)

18001. "Electrolytic condensers." Radiowerke E. Schrack Akt.-Ges. July 1st, 1936. (Cognate application 18002/37.) (482856.)

19191. "Anode for lead electric storage battery and process for manufacturing the same." International Latex Processes, Ltd. July 25th, 1936. (482858.)

23734. "Electro-magnetically or magnetically operated switches." A. Cianchi. August 31st, 1936. (Divided out of 481289.) (482867.)

24927. "Oscillograph electric transient analysers." G. J. Scoles and Metropolitan-Vickers Electrical Co., Ltd. October 7th, 1936. (Divided out of 482956.) (482994.)

25067. "Lamps." Flexible Lamps, Ltd., and E. P. A. Bower. September 15th, 1937. (482869.)

28049. "Snap-action electric switch mechanisms." Westinghouse Electric & Manufacturing Co. October 21st, 1936. (482803.)

28091. "Electrical plug-and-socket connectors." C. G. Hodges. October 15th, 1937. (482934.)

29855. "Thermionic electrodes for electric-discharge lamps." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. November 7th, 1936. (482807.)

32249. "Telekinematograph transmitters." Telefunken Ges. für Drahtlose Telegraphie. November 23rd, 1936. (Addition to 479413.) (482812.)

34763. "Gas-filled or vapour-filled electric-discharge devices." Siemens & Halske Akt.-Ges. December 29th, 1936. (482813.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 27th:—

Traffodol. No. 584640. All goods in Class 1.—The Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, W.C.2.

Circle and parallel bars (design only). No. 575551. Class 8. Cells (dry), electrical, and electrical batteries (not for medical purposes).—Die Accumulatoren Fabrik Gesellschaft, Berlin, S.W.11. (British representatives: Edward Evans & Co., 40, Chancery Lane, W.C.2.

Ver-Be-Sol. No. 583497. Class 9. Electrically and mechanically operated organs and piano-accordions and combinations thereof.—Joseph Verbeeck, 30, Lucerne Road, Highgate, N.5.

White Knight. No. 583707. Class 18. Electric cooking stoves.—Rubery, Owen & Co., Ltd., Darlaston, Staffs.

Magnetic Research Ship

The R.R.S. (Royal Research Ship) *Research*, which is being constructed for the Admiralty by Messrs. Philip & Son, Ltd., at Dartmouth, is to conduct surveys in magnetic variation, and will in consequence be constructed almost entirely of non-magnetic material. She will cost £100,000; the hull will be made of teak, and the framework, girders and fittings will be of bronze or other alloys, and even the cooking equipment must have no steel or iron in its composition. She will cruise mostly under sail, but she will be fitted with an auxiliary heavy oil motor. Her displacement will be 650 tons and she will carry enough fuel to give her a cruising radius of 2,000 miles at a speed of six knots. This non-magnetic ship will replace the American *Carnegie*, which was destroyed by an explosion off Samoa in 1929 after twenty-five years' magnetic survey work. The Carnegie Institution of Washington, U.S.A., lent the services of Mr. W. J. Peters, former commander of the *Carnegie*, to the Admiralty, where he has advised on the design and equipment of the *Research*, whose programme of work includes, beside research on the earth's magnetism at sea, investigation of atmospheric electricity, &c. The ship's instruments will include a marine collimating compass for determining compass variation at sea, a sea-deflector for determining magnetic intensity and a marine earth-inductor.

Netherlands Lamp Import Restriction

The *Board of Trade Journal* states that the Commercial Secretary to H.M. Legation at The Hague reports that, by virtue of Royal Decree No. 11 of April 13th, the importation into the Netherlands of metal filament lamps, whether or not provided with fittings, during the period May 1st, 1938, to April 30th, 1939, is restricted to 50 per cent. of the average number imported during the twelve months of the basis years 1936 and 1937.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barking.—Factory, Alfred's Way; Victor Blaydon & Co., Ltd. Library, Porter's Avenue; Dawson & Allardyce, architects. Extensions to factory, River Road, for P. Winn (Barking), Ltd.; Wood & Goldstraw, architects, Town Hall Chambers, Tunstall, Staffordshire.

Barnet.—Cinema with shops, East Barnet Road, for A. Basal; E. Simmons, architect, 73, Chancery Lane, London, W.C.2.

Barnston (BIRKENHEAD).—Houses (176), Storeton Road; A. J. Milner.

Bedford.—School, and enlargement of Silver Jubilee school; M. J. Slater, architect.

Berwick.—Houses (66), for the T.C.; borough engineer.

Bicester.—Houses (70), Highfield estate (£25,000); U.D.C. surveyor.

Birmingham.—Enlargement of Dulwich Road school (£12,000) for the E.C.

Bolton.—Houses (22), Ainsworth Lane estate; J. Stanton, Ltd. Houses (152), Blenheim Road; Leverhulme estate. Houses (14), near Firwood Lane; Turner Bros. School, Crompton Fold (£20,900); J. & N. Dickinson, Ltd.

Bournemouth.—Coach station, Exeter Road; S. Goodman. Playfield pavilions (£13,100); A. S. Prince & Co. Extensions to St. Walburga's school; R.C. managers.

Brighton.—Dwellings (32), Nelson Street site (£20,247); borough surveyor.

Bushey.—Houses (46), Windmill Lane; N. W. Chappell, builder, Elms Road, Harrow Weald.

Chelmsford.—Houses (32), Fifth Avenue; W. J. Wade. School, Rainsford, for the E.C.

Cheltenham.—Houses (22), Bafford Farm, Charlton Kings; J. Holborrow. Factory, Tewkesbury Road; Gibbard & Co., Ltd.

Chesterfield.—Houses, Bacons Lane, and near Calow Lane; borough engineer, Town Hall.

Chorley.—Houses (44), near Preston Road; W. & P. Knowles, Ltd. Houses (30), Lighturst Lane and Southdown Road; H. W. Rhodes.

Coatbridge.—Houses (200), for Corporation; burgh surveyor.

Colwyn Bay.—Ice skating rink, Colwyn Avenue, Rhos-on-Sea (£30,000); P. Collins, Rhos.

Cumberland.—Police houses, Great Clifton and Skelton, for the C.C.; county architect, 4, Alfred Street North, Carlisle. School, Silloth (£22,703), for the E.C.; J. Twiname, builder, Brigham.

Dagenham.—Houses (171), Bull Lane, Frizland Lane, &c.; Ager & Baker, builders, Fordyke Road, Green Lane. Swimming bath, administrative buildings, &c., The Leys, Old Dagenham Park, for U.D.C.; F. J. Clevely & Partner, quantity surveyors, 47, Gordon Square, London, W.C.1.

Darlaston.—Houses (44), Bentley; Seamen Bros.

Derby.—School (£13,830), Roe Farm estate, for the E.C.; Gee, Walker and Slater.

Doncaster.—Shopping centre at the junction of Sandford Road and Woodfield Road; Wilburn & Atkinson, architects, 11, South Parade.

Dudley.—Houses (18), Pensnett Road; Lloyd Bros. Bank, Castle Street; Westminster Bank, Ltd. Four shops, Rosland estate; borough engineer. Extensions to works, Chapel Street; N. Hingley & Sons, Ltd.

Durham.—Schools, Fishburn and Ushaw Moor, and gymnasium, Leeholme and Pelton schools, for the C.C.; county architect, 34, Old Elvet, Durham.

East Ham.—Maternity and children's wards, East Ham and District Memorial Hospital, Shrewsbury Road (£30,000); J. W. Lohden, architect, 19, Plashet Grove, Stratford, London, E.6.

Edinburgh.—Houses (40), Restalric Road, Leith, for Corporation; city architect.

Enfield.—Houses (215), Bullsmoor Lane; Hilbery Chaplin, Ltd. Houses (146), Durrants Park Avenue; Ellis & Co. Houses (18) and flats, Camberley Gardens; H. C. Smith.

Essex.—School, Chingford; county architect, County Hall, Chelmsford.

Falmouth.—X-ray and massage departments, Falmouth Hospital; Cowell, Drewitt & Wheatly, architects, London House, Bank Street, Newquay.

Gateshead.—Extensions to clothing factory, High Street, for Jacksons, Tailors, Ltd., Newcastle; Stephenson & Gillis, architects, Saville Place, Newcastle. Extensions to factory for Slater & Co., Ltd.; Couves & Partners, architects, Carliol House, Newcastle-on-Tyne.

Glasgow.—Fire station, North Western site (£60,000); Hunter & Clark, Ltd.

Guildford.—Houses (14), Grange estate, Stoughton; J. B. Waltham.

Gwyrfai.—Houses (60), Llanberis estate (£24,710); R.D.C. surveyor.

Harlington (BEDS).—School, Bath Road (£17,397); Y. J. Lovell & Son.

Herefordshire.—County hospital, Hereford, for Herefordshire C.C.

Ilkeston.—Premises, South Street, for Ilkeston Co-operative Society, Ltd.

Jarrow.—Houses (£100,500) and shops, Valley View; borough engineer. Extensions to bakery, Birch Street, for the Jarrow and Hebburn Co-operative Society; G. C. Young, architect, 12, Grange Road West.

Kettering.—Houses, Broughton and Pytchley, for R.D.C.; J. T. Blackwell, architect, Gold Street Chambers. Additions to factory, Shaftesbury Street, for Tailby Bros.

Lancashire.—Schools, Brierfield, Droylesden, Failsworth, Farington, and Penworthan; also enlargement of High School for Girls, Stretford (£24,294), for the County E.C.

Leeds.—Clothing factory for Jacksons, Tailors, Ltd., Newcastle-on-Tyne; Stephenson & Gillis, architects, Saville Place, Newcastle-on-Tyne.

Leicester.—Factory, Braunstone, for Reed and Sigrist, Ltd.; Adie, Button & Partners, architects, 30, George Street, Hanover Square, W.1.

Liverpool.—Factory, Speke estate, for Milners Safe Co., Ltd.

Llantrisant.—Houses (58), various parishes (£26,229); R.D.C. surveyor.

London.—(CHELSEA).—Large extensions (£35,000), X-ray and pathological department, Brompton Hospital for Consumption, Fulham Road. (GREENWICH).—Tenements, Eastney Street (£27,400); Rowley Bros., Ltd., Tower Works, Dunloe Avenue, N.17. (SOUTHWARK).—Tenements (70), for L.C.C., Redcross Street (£32,810); Mitchell & Bridgewater, architects, 42, Bruton Place, W.1. (BILLINGSGATE).—Reconstruction and extension of market (£600,000), for City Corporation; T. S. Tait, architect, 1, Montague Place, London, W.C.1. (GREENWICH).—Houses (200), Wricklemarsh Road; Kidbrooke Park Estates, Ltd., Shooters Hill Road. (HACKNEY).—Cinema, Lower Clapton Road, for British Associated Cinemas, Ltd., Golden Square, London, W.1; W. R. Glen, staff architect.

Manchester.—Houses, Old Moat Lane, Withington, Peel Hall estate, Wythenshawe, and Matthews Lane, Levenshulme; Office of Housing department, Town Hall. Factory, Stretford Road, for National Textile Co.; A. H. Walsingham, architect, 42, Market Street, Deansgate.

Middlesbrough.—Cinema, Corporation Street, for Odeon Theatres, Ltd.; Cussins Contractors, Ltd., Jesmond, Newcastle-on-Tyne.

Morecambe.—Houses (17), Grasmere Road; Widdup & Ladell. Houses (18), Oxcliffe Avenue; R. Naylor. Houses (12), School Green Lane; G. Clark.

Newark-on-Trent.—Additions and alterations, Barnby Road school (£20,394), for the E.C.; G. Brown & Sons, builders, Newark.

Northamptonshire.—School, Duston (£26,640), for the County Council E.C.

Nottingham.—School (2,730 places), Bestwood estate; R. M. Finch, city surveyor, Guildhall. Club premises, Mansfield Road (£50,000), for Y.M.C.A.; T. C. Howitt, architect, St. Andrew's House, Mansfield Road.

Nuneaton.—Houses (42), Vernon's Lane estate; borough surveyor, Council House.

Orpington.—Houses (22), Amhurst Drive, St. Mary Cray; H. V. Manchee, Ltd.

Oxford.—Premises, Queen Street, for Morrison Gowns, Ltd.

Pinner.—School, Marsworth Avenue (£29,864); A. Monk, Lower Edmonton, London, N.9.

Plymouth.—Flats, Salem Street (£13,765), Vauxhall Street (£14,470), and Prince Rock (£6,030); city architect, Guildhall.

Prestbury.—Houses (19), near Moverton Lane; A. Wiggett.

Rochester.—Houses (125), Garden City; R. J. Sargent, architect, 6, Queen Street, London, W.1.

Rowley Regis.—Houses (20), Codsall estate; Clifford Buckley, town clerk, Council House, Old Hill, Staffordshire.

Salford.—Houses (50), Sommerville estate (£19,700); city engineer. School, Broughton (£93,600), for the E.C.

Seaton Valley.—Houses (192), Seghill, for the U.D.C.; surveyor, Council Offices, Shiremoor.

Sheffield.—Houses (44), Manor Laithe Lane; H. Bonner. Flats (71), Clarkhouse Road; C. B. M. Wilson. Cinema and eight shops, Barnsley Road; M. J. Gleeson, Ltd. Law courts and police quarters, and school, Hurlfield Road; city architect.

Stirlingshire. — Schools, Kilsyth, with swimming pond (£68,000), and Westquarter (£35,000); county clerk, Stirling.

Stockton-on-Tees.—Houses, New Blue Hall estate, for the T.C.; borough engineer. Houses (14), Weston Crescent; A. E. Hobbs, builder, Hill House, Norton-on-Tees. Extensions to laundry, Melbourne Street, for the C.W.S.; C.W.S. Architects' Department, 90, Westmorland Road, Newcastle-on-Tyne.

Sutton Coldfield.—Houses (10), Ashurst Road; County Estates (Derby), Ltd. Houses (20), Donegal Road; Mrs. F. Chester.

Tottenham.—Library, Cissbury Road (£9,850); H. Knight & Son, 16, Bruce Grove, N.17.

Tynemouth.—Schools, for the E.C.; W. Stockdale, architect, 73, Howard Street, North Shields. Extensions to Town Hall, for T.C.; borough engineer, 19, Howard Street, North Shields.

Uxbridge.—Houses (54), Cowley Mill Road and Church Lane, Uxbridge Moor, for U.D.C.; W. L. Eves, architect, 54, High Street, Uxbridge.

Warrington.—Mill, Arpley, for Thames Board Mills, Ltd.; Holland & Hannen & Cubitts, Ltd., contractors, 1, Queen Anne's Gate, London, S.W.1.

Washington (Co. DURHAM).—Houses (40), Heworth Road, for the U.D.C.; L. T. Broome, surveyor.

Wednesbury.—Houses (104), Crankhall estate (£35,620); borough engineer.

Whitley Bay.—Houses (30), Broadway estate; Temple and Pyle, builders, Broadway estate, Whitley Bay.

Wigtown.—School, Sandhead (£15,500), for the County E.C.; county architect, Education Offices, Stranraer.

York.—Houses (13), Walney Road; R. A. Cattle. School, Acomb; Penty & Thompson, architects.